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This chapter is divided into two sections. Section 1 provides the purpose of the Maintenance Manual, Volume 1, and offers an overview of the California Department of Transportation Maintenance Program. Section 2 provides general details of Maintenance Program operations.

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## **SECTION 1: ORGANIZATION**

### **1.00 Purpose Of This Manual**

The purpose of this manual is to present general practice and procedures that when followed, will provide for a uniform approach to maintaining the State highway system. The goal of the California Department of Transportation (Caltrans) is to maintain existing facilities as nearly as possible to the original condition as constructed or improved. Because of resource limitations, volume and type of traffic and other factors, it may sometimes be necessary to deviate from standard practices. Discretion must be exercised in those cases, based on experience and the particular circumstances. When deviations are made, the decision and reasons should be documented.

The Maintenance Program is assigned the care and upkeep of State highways. Proper care and upkeep conserves the public's investment in the highway system, and ensures that the system will continue to provide maximum benefits to the traveling public.

The Maintenance Manual is comprised of two volumes. Volume 1 describes the Caltrans Maintenance Program and the methods and procedures it uses. Volume 2 describes the Caltrans Integrated Maintenance Management System (IMMS) used to record, report and monitor maintenance work planned and performed.

All Caltrans Maintenance employees should understand the contents of this manual. Whether their duties call for it or not, employees should also familiarize themselves with similar manuals issued by other branches of Caltrans. Each Maintenance employee should always perform each operation in the safest and most efficient manner, and should make individual efforts to maintain good relations with the public. It is the responsibility of each employee to develop and maintain a positive public image.

This manual is not designed to establish a legal standard of care. It is published solely for the information and guidance of the employees of Caltrans.

It is not intended that any standard of conduct or duty toward the public shall be created or imposed by the publication of this manual. Each chapter in this manual is subject to modifications as conditions warrant.

### **1.01 Maintenance Defined**

Highway maintenance is the preservation, upkeep, and restoration of the roadway structures as nearly as possible in the condition to which they were constructed. "Roadway facilities" includes highways and structures, toll bridges and appurtenant facilities. "Maintenance" also includes the operation of highway facilities and services to provide satisfactory and safe highway transportation.

The legal definition of maintenance as provided by the California Streets and Highways Code, General Provisions, Section 27, includes the following:

- (A) The preservation and keeping of rights of way, and each type of roadway, structure, safety convenience or device, planting, illumination equipment and other facility, in the safe and usable condition to which it has been improved or constructed, but does not include reconstruction or other improvement.
- (B) Operation of special safety conveniences and devices, and illuminating equipment.
- (C) The special or emergency maintenance or repair necessitated by accidents or by storms, or other weather conditions, slides, settlements or other unusual or unexpected damage to a roadway, structure or facility.

The degree and type of maintenance for each highway, or portion of highway, shall be determined at the discretion of the authorities charged with its maintenance, taking into consideration traffic requirements and available funding.

Highway transportation is essential to the economy of the State of California. The closure of a highway may result, not only in inconvenience, but also result in serious economic losses to the traveling public. It is the duty of Caltrans Maintenance to protect the motoring public from these costly interruptions to traffic.

Caltrans Maintenance will react promptly to emergencies while taking steps to protect employees, the public, and the environment. In addition, the Maintenance Program will practice proper scheduling and planning of routine maintenance procedures to keep delays at a minimum. Reasonable efforts should be made to correct conditions that interfere with the orderly flow of traffic.

## **1.02 Maintenance Program**

The Headquarters Division of Maintenance is divided into offices as follows :

- Office of Roadway Maintenance
- Office of Roadway Rehabilitation
- Office of Maintenance Equipment and Training
- Office of Budgets and Planning
- Office of Maintenance Management Systems and Studies
- Office of Management Services and Administrative Support
- Office of Radio Communications Engineering
- Office of Roadside
- Office of Emergency Management
- Office of District Liaison
- Office of Structure Maintenance and Investigations
- Office of Personnel and Field Support

Personnel in the Headquarters Division of Maintenance will perform three (3) essential functions for the maintenance activities they are responsible for:

- (A) Each Office establishes policies and standards for its set of maintenance activities, doing whatever analytical work is required to develop such policies and standards.
- (B) Each Office provides, as required, technical assistance or special expertise to the districts in carrying out the particular set of maintenance activities.
- (C) Each Office reviews the compliance of each district with its standards and policies. District evaluation will include the following:
  - (1) An assessment of work progress comparing the approved work plan with what was actually accomplished.
  - (2) Analysis of the accuracy of Integrated Maintenance Management System (IMMS) as well as the reporting and accuracy of asset inventory data.

- (3) Comments by the Chief, Division of Maintenance discussing:
  - (a) Compliance with policies, procedures, and standards
  - (b) Responsiveness
  - (c) Meeting efficiency objectives
  - (d) Quality of work
- (4) A discussion of deficiencies and plans for correction.

### **1.03 District Maintenance**

The State is divided into twelve districts. The maintenance effort of each district is under the direction of a Deputy District Director, Maintenance. (See Figure 1-2: District Boundary Map).

The Deputy District Director, Maintenance is responsible for all maintenance activities within the district.

#### **(A) Maintenance Support**

Maintenance Support is responsible for coordinating district equipment, the Integrated Maintenance Management System (IMMS), communications, maintenance agreements, service contracts, hazardous materials (self-generated waste and spills), storm water compliance, Level of Service, landscaping, and clerical support.

#### **(B) Maintenance Engineering**

Maintenance Engineering is responsible for storm damage restoration, Day Labor project coordination, field engineering support, design of Major Maintenance projects, coordination between Maintenance and other programs, and all other engineering functions as required.

#### **(C) Region Operations**

A Caltrans Maintenance Region Manager is responsible for field operations and all maintenance activities within each region. The Maintenance Region Manager reports directly to the Deputy District Director, Maintenance.

(D) Area Operations

A Caltrans Maintenance Superintendent is responsible for all maintenance activities in an assigned area within a region. The Superintendent reports directly to the Maintenance Region Manager.

(E) Supervisor Territory

There are individual supervisor territories within the Superintendent's area. Each supervisor is responsible for specific types of maintenance activities within a section of right of way. The supervisor reports directly to the Area Superintendent.

Figure 1-1

CALTRANS DISTRICT BOUNDARIES



## **SECTION 2: GENERAL DETAILS**

### **1.04 Personal Responsibility**

Employees of the State may be held liable for their own actions as a result of their carelessness on the job.

The circumstances under which a State employee could be held personally responsible are outlined in Chapter 3 of this manual, "Liability of Public Employees" (840.2 California Government Code).

### **1.05 Reports of Claims Against Caltrans**

Information regarding claims that arise out of any condition of the highway, or from an act or omission of any officer or employee of Caltrans shall be reported immediately to the Deputy District Director, Maintenance. The Deputy District Director, Maintenance shall transmit the information to the District Claims Officer or the Caltrans Legal Division. The District Claims Officer should be advised of any claims or potential claims as early as possible. Any subsequent information should likewise be reported. The format of such reports to Legal is discussed in Section 1.12.

### **1.06 Loss or Damage to State Facilities**

Every effort should be made to prevent loss or damage to State property by theft or vandalism.

Maintenance stations and offices should be kept locked at all times when a member of the Superintendent or supervisor's staff is not present.

Sections 0601, 2625 and 8657 of the State Administrative Manual provide for the reporting of crimes on State owned properties to either the California Highway Patrol or the local law enforcement agency.

District Security Coordinators shall report, by facsimile, all such instances of crimes to the Office of Statewide Security Operations of the Division of Business, Facilities, Asset Management and Security.

The Office of Statewide Security Operations is responsible for maintaining Departmental procedures concerning crime reporting and providing liaison with the California Highway Patrol and local law enforcement agencies.

## **1.07 Use and Disposal of State Property, and Lost and Found Items**

Caltrans Maintenance employees shall abide by the following guidelines for the policy, rules of conduct, and ethics with regards to the use and disposal of State property, and items found within the State right of way.

Employees who are found to violate these guidelines will be subject to disciplinary action, up to and including dismissal.

### **1.07.1 Use of State Owned Materials, Tools and Equipment**

Employees are prohibited from using State owned materials, tools and equipment for private/personal use.

For example, employees shall not use a State vehicle for their personal use, or use State owned tools for any purpose other than for work-related activities.

### **1.07.2 Disposal and/or Use of Surplus State Property, Salvaged Materials, Junk, Scrap and Trash**

#### **(A) General Directives**

All salvaged and surplus materials not usable in the performance of maintenance activities due to becoming deteriorated, broken or obsolete are considered State property. Salvaged or surplus materials are classified as “junk”, “scrap”, or “trash.”

Junk or scrap has no value in relation to its original purpose of fabrication. However, they have value due to their material content. Examples include broken or deteriorated metal fence, paint pails, and obsolete signs.

Trash is defined as "valueless" either in its original form or in its material content. Occasionally, it may be difficult to determine what material is considered as trash and what is scrap or junk. Supervisors shall ensure that all such items are properly classified.

All materials of value as described above shall be disposed of in accordance with established policies and procedures outlined in the following documents:

- (1) Division of Procurement and Contracts Property Control Manual.
- (2) State Administrative Manual (SAM) Sections 3520.3 (Property Survey Reports) and 3520.9 (Discarded, Scrapped, or Dismantled for Salvage).

All materials of value must be disposed of under the direction of the District Property Controller. When possible, materials of value should be sold. When materials of value cannot be sold, they may be disposed of in an authorized dumpsite or commercial disposal area.

State law and Caltrans policies prohibit employees from taking possession of junk, scrap, or trash to be sold or disposed of by the State. Employees violating these State laws or Caltrans policies are subject to disciplinary action, up to and including dismissal.

It is a violation of the Vehicle Code to tamper with or remove any item from a wrecked, abandoned or stalled vehicle on State highways. This includes cargo or parts spilled at an accident scene.

**(B) Tree Wood**

The following procedures are to be followed in disposing of usable wood generated by trimming and tree removal activities.

- (1) Timber, logs, and wood that have value, shall be sold through the District Property Controller when it is practical to do so.
- (2) All other wood shall be cut in appropriate length and left along the roadside so that the public may pick it up. However, this should be done only if the wood is in an area where it will be safe for the public to stop and pick up the wood. This would not include areas along freeways or multi-lane expressways in either urban or rural areas. In these cases, the wood must be handled as described in (4) below.

Large broken windfall trees shall be removed in large pieces to the nearest wide area where the public can safely stop and pick up the wood.

In some forest areas, it is not permissible to dump wood along the roads. In these cases the wood is to be handled as described in (4) below. Local Park or Forest Rangers may direct disposal of fallen trees in some areas within State Parks or National Forests. However, if Caltrans owns the right of way, the trees are Caltrans property and should not be given to the other party. Trees may have significant value and should be disposed of by the District Property Controller. If there is any question regarding ownership, contact the District Right of Way Division for advice.

- (3) The public shall not be allowed to pick up wood within maintenance work zones during working hours.
- (4) In areas where wood must be removed, it will be loaded and transported to the nearest wide area that is safe for the public to stop and pick it up. If such a spot is not within a reasonable distance, the wood shall be hauled to the nearest suitable disposal sites. Select the method that is the most efficient and results in the least cost to the State.
- (5) State Maintenance yards are not authorized tree wood disposal sites. However, State employees acting as private citizens, on their own time and using their personal vehicles, may pick up and utilize the wood at the appropriate sites described above. In certain areas, the Maintenance station may be deemed the safest, most suitable, and cost-effective location for disposal of tree wood. If so, it is permissible to use the Maintenance station as a disposal site.

**1.07.3          Handling of Privately Owned, Lost, Discarded, Wrecked, Abandoned and Stolen Property on the State Right of Way.**

The District Maintenance Division will provide a reasonable lost and found service to the public. Employees are to turn in, to their supervisor, all items of value found in the course of their employment along highways or in facilities such as Safety Roadside Rest Areas, vista points, Maintenance stations, and other locations within Caltrans rights of way.

Maintenance employees shall not claim items found on or along highways or in State facilities. This is never permitted. Employees who take possession of items found on or along highways or in State facilities are subject to disciplinary action, up to and including dismissal.

Civil Code 2080 provides that a person who finds property shall inform the owner within a reasonable time and return the property to the owner.

Civil Code 2080.1 provides direction regarding property with a value of more than \$100 when the owner of such property is unknown. The property shall be turned over to the city police department if found within the city limits, or to the sheriff's department if found outside the city limits.

Civil Code Section 2080.3 provides that if the owner of property cannot be located, the person who finds the property takes title *"unless the property was found in the course of employment by an employee of any public agency, in which case the property shall be sold at public auction."* (Emphasis added.)

- (A) Based on the above, the following procedure shall be used for items found by employees in the course of their work:

- (1) Value less than ten dollars:

When the value of the item found is estimated at less than ten dollars, the employee will assume custody and turn it in to his or her supervisor. The items will be retained at the Maintenance Region Manager's or Area Superintendent's office.

If the owner of the item can be identified by means of identification, a reasonable effort shall be made to notify the owner of its finding and location, so arrangements can be made to return the property. Such property is generally personal property such as keys, billfolds, pocketbooks, important papers, jewelry, and luggage.

If ownership cannot be determined, or no one claims the property, the item shall be destroyed or donated to any charitable organization after three (3) months. A Form **MTC-900** (Lost and Found Report) of each incident, whether the item was returned or disposed of, must be kept in the region office files for 24 months.

- (2) Value of ten dollars or more:

When the value (purchase or replacement price) of the found item found is estimated at ten dollars or more, the employee will assume custody and turn the item in to his or her supervisor. The item shall be held in the Maintenance Region Manager's or Area Superintendent's office for not less than five (5) days or more than 15 days, pending claim by the owner.

Bulky items may be held at the most convenient crew supervisor or Area Superintendent station. If ownership can be determined, a reasonable attempt will be made to notify the owner of its finding and location.

If no one claims the property within the above time frames, the property shall be turned over to either the police department if found within city limits, or the sheriff's department if found in an unincorporated area.

A signature from the person receiving the item should be obtained on the Form MTC-900 and should be filed in the region office.

In jurisdictions where the law enforcement agency will not accept the item found from Caltrans, such property shall be retained at the Maintenance Region Manager's office for at least three (3) months. If the property is still unclaimed, the property shall be turned over to the District Property Controller, who will make arrangements for its disposition.

Items found on State right of way shall not be retained by an employee under any circumstances.

**(B) Miscellaneous Items and Materials**

- (1) Many materials and junk type items that are found along the State highways such as hubcaps, pipe, and tire chains, have scrap or junk value. Such items, when picked up or salvaged are to be added to the accumulations of salvage material as described previously under 1.07.2. They shall be disposed of as State property.
- (2) The separation of recyclable litter such as aluminum cans or returnable bottles from other litter cannot normally be justified on a cost benefit basis. Such items are to be picked up and disposed of as trash under normal disposal procedure.

Private individuals may collect items such as aluminum cans from along conventional roadsides, but not from freeways. They may also collect aluminum cans or returnable bottles from trash barrels at Safety Roadside Rest Areas.

Any separation of such items from routine litter must be authorized in writing by the Maintenance Region Manager. Such authorization will generally be associated with special public relations or volunteer projects.

**1.07.4 Use of State Maintenance Facilities**

Maintenance facilities cannot be used as recreation or storage areas by employees or the public. Maintenance facilities are not to be used for servicing, repairing or storage of private vehicles, boats, trailers or other privately owned equipment. These activities must be restricted to the residential areas of State facilities with dormitories or employee housing.

**1.08 Departmental Personnel Policy**

The Division of Human Resources, Office of Transaction Services will furnish information or answer questions concerning any specific problem that may arise in connection with civil service procedures or Departmental personnel policy.

### **1.09 Merit Award System**

The Merit Award Program was established by the State Legislature to provide an opportunity for all California State employees to submit constructive ideas that will both improve the effectiveness and reduce costs of State government. All Caltrans employees are urged to develop and submit ideas that will improve the operation of State government. Cash awards can be made for procedures or ideas, that if implemented, actually reduce State costs or increase safety.

Employees can obtain the Merit Award Form Std 645 from *Forms Flow* on the Caltrans Intranet, or from their supervisor

### **1.10 Reporting Occurances Operating Conditions**

Caltrans has the responsibility to disseminate highway condition information to various governmental agencies. In addition, Caltrans advises the public of current statewide highway status through the Caltrans Highway Information Network (CHIN).

Unusual occurrences require immediate notification to the Chief, Division of Traffic Operations.

Examples of unusual occurrences include damage or closure of highways due to earthquakes or floods, hazardous spills, accidents, or death or serious injury of an employee.

Districts shall send such reports by established procedure to the Headquarters Communications Center, Division of Traffic Operations.

Headquarters Communications Center, Division of Traffic Operations

Telephone: (916) 653-3442  
Calnet 8-453-3442

Facsimile: (916) 653-3291  
Calnet 8-453-3291

Districts shall provide updated information to the Chief, Division of Traffic Operations via the Headquarters Communication Center through facsimile transmissions, as needed, until the conclusion of the occurrence.

## **1.11 Accounting Procedures**

Accounting and clerical work carried on by the Maintenance Region Managers are to be governed by the Accounting Manual and Regional Administrative Officer (RAO) Procedures Manual.

### **1.11.1 Accounting Distribution of Labor and Operating Costs**

Supervisors shall prepare daily reports of the labor, equipment, materials and supplies used in performing the work under their supervision.

Instructions for preparing the required reports are contained in the Maintenance Manual, Volume 2.

### **1.11.2 Damage Report Number**

When an Accident Log is created in the Integrated Maintenance Management System (IMMS), an Accident Log number is generated by the system.

### **1.11.3 Daily Record of Rental Equipment**

The use of privately owned equipment, rented for State work, is to be reported on Form DM-M-8 with a positive identification for each unit of equipment. This form must be completed in full to show the work order and service contract numbers, actual hours worked, as well as travel. Hours rented, including standby time are to be distributed by county, route and post mile designation. Signature of the vendor or his / her agent must be secured.

### **1.11.4 Service Contracts**

The Division of Procurement and Contracts (DPAC) Service Contract Managers Manual includes detailed instruction in the preparation of Service Contracts. It is located on the DPAC's web site. The Contract Managers Handbook is also available on the web site. See these documents for detailed instructions regarding Service Contracts.

The requesting unit designates a contract manager. All contract managers are required to complete the Contract Managers Training on line for the particular type(s) of contracts they manage at the DPAC's web site.

Form ADM 360, the Service Contract Request, is required to start the contract request process. This form and instructions for its use are available on the DPAC's web site.

Questions can be addressed by calling DPAC's main number at (916) 227-6000 or Calnet 8-498-6000.

In cases where emergency work is necessitated by the threat or occurrence of a landslide, flood, storm damage, accident or other disaster, tools or equipment may be rented for a period not to exceed 60 days without competitive bidding. A formal contract must be awarded within 20 days if the work is expected to take longer than the 60 day emergency authorization. See the Contract Managers Handbook for instructions.

#### **1.11.5 Receiving Records and Correspondence**

No obligation should be paid unless supported by a Receiving Record. Receiving Records (Form DAS-FM-1226) should be signed by the Maintenance Region Manager. Vendor delivery tags should be attached to the receiving record.

Shipping Record Form DAS-FM-1126 is used when materials, supplies or equipment are transferred to another district, or between Maintenance Region Managers within a district.

Copies of all letters, reports and records shall be retained in the region office files. When a letter is received requesting information that cannot be furnished within a few days, the letter should be acknowledged at once with a statement as to the probable date the required information can be supplied.

### **1.12 Accident Reports**

The Caltrans Safety Manual includes detailed instructions regarding reporting accidents.

Consult the District Safety Officer if there is doubt regarding which form to use, or if assistance is required in documentation preparation.

Accident reports are to be treated as confidential, and are for the use of the Traffic Operations Program, the Equipment Service Center, and the Legal Division. Reports to Attorney of Potential Claims are also confidential, and should only be submitted to the District Claims Officer or directly to the Legal Division.

#### 1.12.1 When to Report Accidents

All accidents which involve State owned motor vehicles in any way must be reported within 48 hours on Std. Form 270. Accidents resulting in any injury to persons other than employees, or involving serious damage to the property of others, must be reported immediately by telephone or telegraph to the nearest claims adjusting office for the State as shown on Std. Form 269. District employees will report such accidents through their district office.

The driver of a State owned motor vehicle involved in any accident resulting in injury, death or serious property damage shall immediately report each accident to the California Highway Patrol, except when the accident occurs within city limits. When within city limits, the report shall be to the city police.

Serious damage to property has been defined as damage to any one person's property amounting to \$500.00 or more.

Forms 270 and DAS-S-270 must be submitted when it might be claimed that the location or position of State vehicles near the highway might have brought about damage to another vehicle.

#### 1.12.2 Vehicle Accident Reports

Accident reports must be truthful and complete. Reports shall include the names of drivers of the vehicles involved, names of witnesses, statements by drivers, and a description of how the accident occurred. Take pictures if a camera is available. An Accident Identification Card (Std. Form 269) is located in all Caltrans vehicles and must be filled out at the accident scene to record pertinent information needed to complete Std. Form 270, Report of Vehicle Accident. Statements of witnesses should be submitted on separate sheets, in duplicate, with Std. Form 270. Be sure to differentiate between conclusions and statements of fact. All information must be as complete and precise as possible, and sketches should be shown if the accident data will permit. It is essential that the reports show the actual location of the accident, and if known, the direction of travel of the vehicle or vehicles involved; the hour, and weather.

##### (A) Collision Accident Information

Under no circumstances shall a State employee make a private settlement with an adverse party regardless of how minor the damage to the adverse party may be. A State employee involved in an accident shall not discuss conditions of an accident with an adverse party or his or her representative, nor commit the State to repair any alleged damage. In no case, upon the occurrence of an accident, shall the State employee tell the adverse party that the State will initiate action toward making repairs to the vehicle or property of the adverse party.

An employee, in addition to submitting the required reports to his or her headquarters, should use the tear off portion of Std. Form 269 to furnish the following information to the other party:

- (1) Driver's name and drivers license number.
- (2) License and C numbers of vehicle.
- (3) Name of owner (Caltrans).
- (4) Office of Risk and Insurance Management (ORIM) telephone number:  
(916 376-5300).

ORIM handles insurance claims involving Caltrans employees on State business. If an employee receives any communication relating to damage to another party's vehicle in which he or she may have been involved, the employee should immediately forward such communication to the District Claims Office.

**(B) Employee Injury Resulting from Motor Vehicle Accident**

A motor vehicle accident involving an injury to a State employee and occurring during the hours of employment must be reported to the District Safety Officer on the same forms and in the same manner as described for industrial accidents. In addition, the following forms may be required:

- (1) Std. Form 270, State of California, Report of Automobile Accident.

This report is required to be submitted within 48 hours when a State vehicle or any privately owned vehicle is damaged. This report is also required when a State vehicle damages the personal property of another, or when it is alleged a State owned vehicle is in such proximity as to have been a factor in causing the accident.

- (2) Form DAS-S-270, Report of Automobile Accident Investigation.

This report is to be completed by the employee's supervisor and is submitted with the Std Form 270 report.

The required reports must be prepared by the injured employee, or on his or her behalf, if their injury is so severe that the employee cannot complete them.

(C) Supervisor's Responsibility

The immediate supervisor shall investigate employee injury accidents or vehicle accidents to determine the causes. Form 66 is used for reporting minor employee injuries that require only first aid. Form 67 must be used for employee injuries that require medical attention or result in lost time. The immediate supervisor shall counsel or train the employee when it is appropriate, and initiate procedures to prevent similar accidents in the future. If the immediate supervisor cannot place the needed action into effect, he or she shall consult with the second line supervisor for assistance.

The second line supervisor will review the action taken in each case and concur, modify, or change the steps taken or recommendations made.

In vehicle accident cases, the second line supervisor will classify the accident as to whether it was Class I, II or III. If it is a Class III accident, the second line supervisor will determine the cause and review the record.

The immediate supervisor will sign the back of Form DAS-S-270 along with his/her comments in the appropriate place. The second line supervisor will sign and mark the front of DAS-S-270 as to cause, and provide any other appropriate comments in the "Action" block.

After an accident report has been classified, it shall be forwarded to the District Safety Officer. The Safety Officer will present the report to the District Accident Prevention Committee for consideration.

1.12.3            Damage to State Highway

Damage to State highway is recorded in the Integrated Maintenance Management System (IMMS).

Any damage to State property must be recorded. There is no minimum dollar amount.

One of the two options listed below shall be used to record damage to State property in IMMS:

- (A) When responsible party is known (billable), a Service Request and Accident Log, as well as the Work Order(s) are created in IMMS, and the IMMS Damage Reporting Guidelines must be followed.

- (B) When the responsible party is “unknown”, the Problem Code ACUNK (Accident Unknown) is entered on the IMMS Work Order in the Problem field. If the responsible party is identified at a later date, the ACUNK entry in the Problem field can be changed to ACDNT, and an Accident Log and Service Request created.

If the damage is to an electrical asset (traffic signal, highway light, etc.) that is under a cost sharing agreement with a local agency, use option “A”, and the billable party will be the local agency. See specific instructions for electrical assets at the Intranet, Maintenance Division, IMMS web site.

When the responsible party is known, there are three components for the Damage Reporting process in IMMS:

- 1) Accident Log
- 2) Work Order(s)
- 3) Service Request

The Service Request links all Work Orders and the Accident Log. Each region should have a system for tracking the status of Accident Logs and checking for completeness before validating. Documents related to Accident Logs should be kept on file at the region office for the appropriate retention period.

Police reports must be obtained when an officer has responded to an incident resulting in damage to State property. If the reporting agency has left the scene and has not left any tag, or other type information, contact should be made with that agency for additional information. The Damage Reporting process is very important to the Maintenance Program. Funds recovered from responsible parties are returned to the district that used the resources to repair the damage. If the Damage Reporting process is not followed, valuable funds that were intended for highway maintenance are lost. Every effort should be made to complete the Damage Reporting process within 90 days.

For detailed instructions regarding the Damage Reporting process visit the Maintenance Division, IMMS Intranet web site, or contact your District IMMS Coordinator.

### **1.13 Assistance in Fighting Fire**

Maintenance forces shall be vigilant at all times to detect and control fires that may start within the right of way. All employees are expected to give warning, notification, and assistance whenever grass or brush fires are discovered along or adjacent to the right of way.

Caltrans Maintenance is in a position to render valuable service in preserving public and private property from grass and forest fires due to its extended locations, the nature of its duties, and the variety of its equipment. Caltrans has entered into cooperative agreements with the United States Forest Service and with the State Department of Forestry that formalize its role in fighting fires.

The terms of these agreements are set forth in the appendices following this chapter.

### **1.14 Cooperation with U.S. Forest Service**

Caltrans has entered into an agreement with the United States Forest Service to aid in the suppression of forest fires in the National Forests. The terms of this agreement are set out in Appendix 1-A.

### **1.15 Cooperation with California Department of Forestry**

During times of fire or other emergencies, The California Department of Forestry (CDF) may request Caltrans assistance to provide Caltrans personnel, equipment, and materials.

Caltrans has entered into an agreement with the CDF. The terms of this agreement are set out in Appendix 1-B.

### **1.16 State Highway Maintenance Agreements**

The Streets and Highways Code provides Caltrans with authority to enter into contracts and agreements with local agencies and permits delegation of the Caltrans powers and jurisdiction over any portion of State highways within a city or county. Delegation of maintenance is permitted by Section 116. Section 130 provides authority to enter into a contract or agreement with the local agency.

If a city or county is delegated any maintenance work on a conventional State highway, a Maintenance Agreement must be processed. The agreement should pertain only to those specific functions that are delegated to the local agency. Statements as to what functions the State will perform are unnecessary. The agreement shall specify, by total dollar amount per route, the degree of maintenance that Caltrans has determined as appropriate for the delegated work.

Caltrans will reimburse the city or county their actual cost for delegated routine maintenance work performed. Annual expenditures per route may not exceed agreement amounts without prior approval of the District Director. The agreement may be amended, as necessary, to ensure that the expenditures per route are equitable for the following fiscal year. It is the responsibility of the Maintenance Area Superintendent to see that the agreed upon funds are provided to the city or county, and that the local agency has a plan in place to perform the work.

The expenditure per route for delegated routine maintenance work specified in the agreement may be increased or decreased, or additional expenditures for specific projects may be authorized by the District Director.

Although the District Director can approve specific delegated maintenance work, the district still must write a letter to the Division of Maintenance that will be used to notify the State Controller's Office of the new agreement spending capacity.

The District Director is authorized to approve the agreements that do not deviate from the pre-approved agreement forms. Prior Division of Maintenance approval is required if the agreement varies from the standard form.

One fully executed copy and two signature-stamped copies of all agreements, or amendments, shall be forwarded to the Division of Maintenance.

The Area Superintendent is responsible for assuring that maintenance work delegated to a local agency is actually performed and conforms to State levels of service. State highways having delegated maintenance functions should be reviewed at least monthly to ensure that work paid for complies with State standards and the terms of the agreement. Inexcusable noncompliance is justification for rescinding the delegation of specific maintenance functions.

### **1.17 State Maintenance of City or County Owned Facilities**

Section 131 of the Streets and Highways Code provides that any city, county or other governmental agency may request that Caltrans perform maintenance work on facilities owned by the local agency.

If State personnel performs routine maintenance of traffic control systems or other facilities on county roads or city streets, a cooperative agreement must be processed. The agreement format should be as set forth in the Caltrans Cooperative Agreement Manual. Districts shall not enter into new cooperative agreements to maintain local facilities without prior approval from the Division of Maintenance. Districts should take steps to discontinue existing agreements to wash tunnels, maintain traffic signals and maintain streetlights for local agencies.

Any agreement for other work to be performed for a local agency should also follow the format of the Cooperative Agreement Manual. Approval by the Headquarters Office of Service Contracts is required for all cooperative agreements.

### **1.18 Maintenance of State Park Roads and Parking Areas**

In addition to State highways in or through State parks, Caltrans is authorized under Sections 122 and 193 of the Streets and Highways Code to perform maintenance on other roads within a park.

All work in a State park, except for that on a State highway, shall be performed under authority of an interagency agreement with the Department of Parks and Recreation.

Refer to Chapter 2: Resource Management, for details regarding maintenance of State Park roads financed by others.

### **1.19 Agreements on Cooperative Projects With Non-State Agencies**

A formal agreement is required on all projects where parties other than a State agency are to participate, either by payment for work performed by Caltrans, or by contributing labor, equipment or material.

Refer to Chapter 2: Resource Management for details regarding work for other agencies.

Drafts of all proposed agreements of this type shall be forwarded to the Headquarters Division of Procurement and Contracts for legal and procedural review and approval in accordance with the Caltrans Cooperative Agreement Manual.

## **1.20 Freeway Maintenance Agreement**

Freeway Maintenance Agreements define the responsibilities that must be accepted by each agency (State, city or county) upon the completion of a new freeway.

A Freeway Maintenance Agreement should be negotiated with the city or county as soon as all detailed features and roadway configurations (such as off and on ramps) are known, so as to permit the respective agency to assume their maintenance responsibilities as rapidly as possible after acceptance of the contract. Caltrans will retain full jurisdiction over maintenance and control of all portions of the freeway proper. Caltrans will also maintain approach ramps, grade separations, and similar installations, within rights of way secured for the exclusive use of traffic entering, leaving or traveling on the freeway. This includes undercrossings or overcrossings whose prime purpose is to serve as crossings for freeway traffic, and whose use by local traffic is incidental.

The local authority should maintain all other portions of streets or roads, including outer highways, approaches to ramps, overcrossings, and undercrossings that serve adjoining property and local traffic.

In general, Caltrans will retain title to and be responsible for the maintenance of all property on which access rights have been secured. However, if the local authority desires, Caltrans may transfer title on those areas of uncontrolled access that are to be maintained by the local authority.

If the pre-approved form for Freeway Maintenance Agreements is used, the agreement may be negotiated by the district without prior approval by the Division of Maintenance. Prior Division of Maintenance approval is required if the Freeway Maintenance Agreement varies from the standard form.

One fully executed copy and two signature-stamped copies of all agreements, or amendments, shall be forwarded to the Division of Maintenance.

## **1.21 Maintenance Within Construction Limits**

This subject matter has been moved to Chapter 11 of this manual.

## **1.22 Maintenance Review of Construction Projects**

This subject matter has been moved to Chapter 11 of this manual.

### **1.23 Protection of Sensitive Environmental Resources**

Damage or degradation to the environment shall be avoided to the extent possible during maintenance activities. The term “environment” as used in connection with highway maintenance work refers to the natural surroundings including soil, water, air, plant and animal life, and archaeological and historical resources.

All Maintenance personnel must be aware of the need for environmental protection in the performance of their duties. While some environmentally sensitive areas are easily identified, others are not so obvious to untrained persons. For example, a rare plant may not be identifiable as such by anyone other than a plant expert. Maintenance employees have a responsibility to take reasonable steps to protect the environment, even when resources are not easily identified.

District Environmental Divisions can provide information on identifying, protecting, and avoiding or minimizing harm to environmental resources. The Environmental Division will advise the Deputy District Director, Maintenance of such resources, locations and sensitivities.

Maintenance personnel should be notified to prevent damage or destruction of environmental resources.

#### **1.23.1 Archaeological, Historical, Cultural, and Sensitive Biological Resources**

Some Maintenance operations have potential for damaging or destroying archaeological, historical, and sensitive biological resources, as well as culturally sensitive resources, such as Native American plant gathering areas and sacred sites. These include activities in areas of highway right of way lying between the regularly maintained roadway and the right of way.

Examples of such operations are removal of material, grading, filling of material, trenching, guardrail or culvert repair and replacement, and vegetation control activities.

The Deputy District Director, Maintenance is responsible to coordinate with the District Environmental Division to identify locations of resources that could be disturbed by maintenance operations. The District Environmental Division will provide guidance to assist Maintenance in avoiding destruction or damage to archaeological, historical, cultural, and sensitive biological resources present within the State highway right of way.

If human remains, prehistoric or historical archeological or sensitive biological resources are discovered by Maintenance forces, work in the area of discovery must stop, and the discovery reported immediately to the Deputy District Director, Maintenance. The Deputy District Director, Maintenance must immediately contact the District Environmental Division.

The Deputy District Director responsible for environmental issues will notify the Deputy District Director, Maintenance when environmental concerns have been addressed and work may proceed.

The discovery of human remains is a sensitive situation. It is a felony to further disturb the remains until procedures outlined in Section 7050.5 of the Health and Safety Code and Public Resources Code Section 5097.98 are followed. Pursuant to these regulations, the County Coroner must be notified immediately when human remains are found. The Maintenance Supervisor must, through his or her chain of command, attempt to notify the following persons to report the finding:

- (1) Deputy District Director, Maintenance
- (2) Deputy District Director responsible for environmental issues.
- (3) District Native American Coordinator

It is the responsibility of the persons listed above to contact the County Coroner when human remains are discovered. If none of these persons are available, the supervisor shall directly contact the County Coroner, and then notify those noted above.

#### 1.23.2 Water Quality

Many routine maintenance operations have the potential to affect water quality. The Maintenance Program, in cooperation with the Environmental Program, has developed procedures to protect water quality. These are included in the Maintenance Manual, and in the Caltrans Statewide Storm Water Management Plan. Caltrans has a statewide storm water permit. All districts are required to abide by the permit requirements.

See Chapter “F” of this manual, for the Maintenance Storm Water Pollution Prevention Program background information, instructions, and guidelines for protection of storm water.

#### 1.23.3 Underground and Aboveground Tanks

California and federal regulations and laws address the problem of contamination of underground water supplies by hazardous substances (such as gasoline, diesel, oil, and solvents), leaking from underground and aboveground storage tanks. These regulations and laws require that the owners and operators of underground and aboveground tanks obtain tank-operating permits from local agencies, monitor tanks for leakage, and promptly report and abate any leakage. See Article 5, Section 2650-2655, Title 23, Chapter 16.

However, after several reviews by our Legal Division, the Department is exempt from payment of all fees to the State Water Resources Control Board for above ground petroleum tanks.

**(A) Permits**

Districts shall submit applications to appropriate cities or counties for permission to operate all underground tanks used to store hazardous substances. Periodic renewal of these permits will be required. Underground tanks that are no longer in use shall be removed in accordance with local tank closure procedures. The District Facility Coordinator should be notified of any tanks that require removal.

**(B) Monitoring**

Underground and aboveground tanks shall be routinely monitored to detect any leakage. Additional monitoring may be required due to local regulations.

**(C) Determining Leakage**

The presence of water or sand in the stored product and unusual variances in inventory are reasons to suspect a breach in the integrity of the tank system. The Maintenance Region Manager shall report to the local Certified Unified Program Agency (CUPA) any suspected leak. The Maintenance Region Manager shall also report the suspected leak to the Headquarters Underground Tank Coordinator. Monitoring results from a release detection method indicates a release has occurred. Further investigations should be made to determine if a leak has occurred, and that the monitoring device is not defective. Only approved precision tank test methods should be used. For assistance on leak test methods, contact the local agency or the Headquarters Underground Tank Coordinator.

**(D) Reporting**

Suspected leaks should be brought to the attention of the Maintenance Region Manager responsible for the station where the tank is located. The Maintenance Region Manager is responsible for initiating follow up investigations of suspected leaks, and reporting confirmed leaks to the local agency and the appropriate Regional Water Quality Control Board.

Confirmed leaks must be reported within 24 hours after a leak is confirmed. A full follow up written report is required within five (5) working days.

(E) Leak Abatement

Obtain advice regarding local agency or Regional Water Quality Control Board requirements for abatement of leakage when making the initial notification. Typically, this will require removal of product from the tank, determining the source of the leak through a site investigation, and removal and disposal of soil contamination.

Procedures established by the Department of Toxic Substances Control regarding the manifesting, transportation, and disposal of hazardous wastes shall be followed if contaminated product, tanks, or soil are removed. The District Hazardous Materials (Hazmat) Manager and the District Hazardous Waste Coordinator should be consulted regarding proper procedures. When possible, avoid disruption of Maintenance operations and duplication of work by coordinating the removal and disposal of underground fuel tanks.

(F) Funding

Costs associated with the permitting of tanks, precision testing, site investigation for leakage, replacement, including decontamination, and removal and replacement of tanks should be considered support costs. The District Underground Tank Coordinator should be given early notification of suspected leaks so he or she can initiate a project to correct them.

1.23.4 Streambed Alteration

The California Fish and Game Code (Sections 1601 and 1603) requires advance notice to the Department of Fish and Game (DFG) when work to be performed will "... divert or obstruct the natural flow or change the bed, channel, or bank of any river, stream or lake designated by the DFG, or use any material from the streambeds." This notice includes the submittal of general plans indicating the nature of the project.

If an existing fish or wildlife resource may be substantially adversely affected by the project, DFG is required to propose reasonable project modifications within 30 days of their notification.

These modifications are formalized in a Streambed Alteration Agreement. Work with your Environmental Division to obtain approval prior to starting work.

Caltrans employees who proceed with projects that affect stream flow without giving the required notice to DFG are subject to disciplinary action and criminal prosecution.

Emergency work necessary to protect life and property is not subject to the provisions of these sections. However, DFG must be notified within 14 days of the start of emergency work.

### 1.23.5 Air Quality

Exhaust and crankcase emissions from gasoline powered vehicles are a prime source of the air contaminants: carbon monoxide, nitrogen oxides, and hydrocarbons.

Particulates (small airborne particles) are another form of air pollution. They can be caused by human activity or by nature. Particulates constitute an irritant and a health hazard regardless of their source.

Particulates are normally thought of as dust or small dirt particles suspended in the air, but they may be found in many forms. One form of particulates are those that come directly from vehicles.

They are small pieces of asbestos (from brake linings or from naturally occurring asbestos deposits), rubber (from the grinding of tires against the road), carbon soot from the exhaust, and products of internal combustion engines. Two other forms of particulate pollution are dust from the roadside and smoke from burning.

#### (A) Exhaust Emission Controls

There is a direct correlation between vehicle mode of operation and the amount of exhaust emissions from gasoline-powered vehicles. The best condition for overall low emissions is a steady cruise mode of operation.

Smooth traffic flow lessens the impact of highways on the surrounding environment. Maintenance practices that help achieve smooth traffic flow are:

- (1) Maintaining the roadway to enable steady cruise speeds.
- (2) Installing and maintaining guide markers and signing to permit smooth transitions and even flows of traffic.
- (3) Providing efficient traffic control, when the normal flow is interrupted, to lessen the impact on traffic conditions.
- (4) Organizing maintenance work so that it will not distract motorists and interrupt traffic flow.

Proper maintenance of the Caltrans equipment fleet also helps to protect air quality. It is important that the vehicles and equipment Caltrans operates have the lowest emission rates possible. Any malfunctioning equipment should be brought to the attention of the Equipment Shop for correction.

**(B) Dust Control**

Some highway maintenance activities can raise dry particulates into the atmosphere.

Activities that raise dust include grading of roadside shoulders and open right of way, mowing of dry grass along the roadway, sweeping of gutters and shoulders, hauling of dry materials, and cultivation of right of way ground.

Controlling factors in the dust problem are wind conditions during the operation, moisture content, and the relation of the operation to surrounding population or crops.

Where possible, these operations should be done in light wind (0-5 mph) with use of water application for retarding dust or particles. Operations upwind of sensitive areas should be curtailed on windy days.

Maintaining a vegetative cover alongside the roadway will keep down the amount of dust stirred up by passing vehicles. It will also tend to trap a significant portion of the asbestos, heavy metals, rubber and soot coming from the vehicles themselves.

In natural occurring asbestos areas regional quality control boards require pre-notification of highway activities producing visible dust.

**(C) Burning Controls**

All burning must be regulated as to time and atmospheric conditions. California is divided into eleven different air basins (areas of like topography and meteorological conditions), each of which has controls on emission of pollutants for its special conditions of industry, meteorology, population, and other factors.

Emission controls vary widely with conditions present in each air quality basin.

Therefore, controls vary in different areas of the State. To assist in minimizing the effect of air pollution, guidelines have been set up for all burning connected with any maintenance, office or shop operation of Caltrans. These guidelines to control burning are all inclusive. These guidelines apply to the following:

- (1) Trash burning at any of Caltrans permanent or semi-permanent operational facilities.
- (2) Maintenance activities that include burning brush, tree trimmings, tules, thistles, tumbleweeds, or any vegetation. Prescribed burning, a type of thermal control, is also included.

- (3) Burning of any roadside litter at any location.

These guidelines cover all types of burning whether it is an open fire, prescribed burn, mechanically induced fire, fire in an open or closed incinerator, or burning in a so-called "approved incinerator."

In many areas, burning is governed by the local city or county ordinance, by State or Federal Forest Service regulation, or by other recognized air resources jurisdictions. In these areas, burning is allowed only when the ordinance, regulation, or jurisdiction allows. All conditions imposed by the ordinance, regulation, or jurisdiction shall be followed.

Lacking such an ordinance or other governing jurisdiction, burning is prohibited within any incorporated city or unincorporated community and the adjoining residential areas.

In rural areas, the burning of standing material is permitted. However, burning shall be conducted only when weather conditions are favorable for good smoke dissipation.

Burning will not be permitted under any conditions of wind that might transport burning materials.

The burning of tires, tarpaper, and other potentially hazardous materials is prohibited under all conditions.

If burning is the best method, all regulations shall be followed closely and the proper permit obtained.

## **1.24 Controlling Noise from Maintenance Operations**

Maintenance of the transportation system involves the use of various types of vehicles and equipment. Mufflers or noise-suppression equipment should be kept in proper working order.

The District Safety Officer can use meters to measure noise levels. The Safety Officer can also make recommendations for protecting Maintenance personnel from high noise levels. If operating maintenance equipment results in excessive noise, take steps to ensure that nearby residents and businesses will not be adversely affected.

The Caltrans Safety Manual, Chapter 13, Hearing Protection, provides that employees shall wear hearing protection when noise levels exceed 90 decibels. This requirement affects many maintenance operations. For example, an employee operating brush chippers and chain saws is exposed to over 110 decibels. See the Caltrans Safety Manual, Chapter 13: Hearing Protection.

## **1.25 California Emergency Services Act**

In 1970, the California Emergency Services Act established the authority for conducting emergency operations after declaration of emergencies by either the Governor or local jurisdiction. The Act is set forth in the Government Code, Sections 8550 through 8668, and includes for the following:

- (A) Confers emergency powers upon the Governor and the chief executives of political subdivisions, and provides for State assistance in emergency programs.
- (B) Establishment of Governor's Office of Emergency Services (OES), which is responsible for oversight and coordination for all statewide emergency preparedness, coordinates overall State response to major disasters, and oversees post emergency mitigation efforts.
- (C) Provides for the assignment of functions to State agencies to be performed during emergencies, and for coordination of direction of emergency actions.
- (D) Provides for mutual aid by State government and political subdivisions.
- (E) Authorizes establishment of organizations and actions to carry out provisions of the Act.

The Act provides that the Governor may assign to a State agency any activity concerned with disaster mitigation. Each department and State employee is required to render all possible assistance to the Governor and to OES in carrying out emergency operations. As a State department, Caltrans is required to cooperate with other State agencies and with local jurisdictions.

The Governor has power to take extraordinary action to protect the public interest during an emergency. For example, Caltrans could, in some cases, be required to use State personnel and equipment to clear and dispose of debris on private property. Any action of this nature would be coordinated between the Division of Maintenance and OES, under the authority of a Mission Number issued by OES.

### **1.25.1 Department of Transportation Authority**

Caltrans is responsible for the administration, construction, and maintenance of the State highway system. The primary function of the Maintenance Program in both man-made and natural disaster is to maintain the State highway system in a safe and operable condition.

Government Code Sections 14120 through 14120 authorizes Caltrans to perform any work or remedial measures necessary to avert, alleviate, repair or restore damage or destruction to property having a general public and State interest. Caltrans will take action to protect the health, safety, convenience, and welfare of the general public of the State.

During disasters resulting from storms and floods, the Director of Transportation may declare the existence of an emergency when it is a matter of concern to the general public and to the State, and when work is required to avert or repair damage or destruction to highways.

Caltrans may provide assistance to other levels of government for maintenance or restoration of streets or highways, or for non-highway work, only when such work is properly requested and authorized by OES. Approval for such work will be given only when the work is within the legal scope of authority granted to Caltrans by statute or specifically authorized by the Governor.

OES will grant immediate authorization to proceed with assignments of personnel and equipment necessary to cope with a particular emergency.

#### 1.25.2 Radiological Emergencies

The California Highway Patrol (CHP) is the designated statewide lead in radiological emergency response. Caltrans is not required to perform radiological monitoring on a statewide basis. However, in some areas of the state, districts may perform radiological monitoring as part of local emergency plans. Districts that will perform monitoring may obtain monitoring instruments from the Emergency Operations Center (EOC). These instruments should be inspected quarterly to ensure proper function. The District Maintenance Hazardous Materials Manager (Hazmat Manager) shall be responsible for the proper care and maintenance of radiological monitoring instruments in the district.

If a district elects to participate in radiological monitoring, it shall provide training to employees who are to use the instruments. All districts shall provide radiological awareness training to field Maintenance employees annually during Hazardous Materials: First Responder Awareness training.

### **1.26 National Incident Management System (NIMS)**

As a department of State government, Caltrans is required by Federal and State directives to be NIMS compliant. Being NIMS compliant means personnel with a direct role in emergency management or response should have at least eight hours of NIMS training.

All Caltrans Maintenance field personnel from Service Assistant Maintenance (SAM) through the rank of Supervisor, shall attend the NIMS training course.

Maintenance Area Superintendents, Maintenance Region Managers, and district Maintenance management shall complete the NIMS Field Course. Hazmat Managers and district management staff designated to report to the Regional Emergency Operations Center during an emergency shall attend the NIMS Incident Command System (ICS) Course. It is recommended that Deputy District Directors, Maintenance also attend this level of training.

### **1.27 Underground Service Alert**

California Government Code Sections 4216 through 4217 provide that any person who undertakes an underground excavation project contact Underground Service Alert (USA) prior to work.

Any person who damages underground services as a result of failure to notify USA is liable for both criminal and civil sanctions. Both individual employees as well as Caltrans can be held liable for negligent or knowing violation of the law. Caltrans will take disciplinary action, up to and including dismissal, on employees who willfully violate notification requirements.

Appendix 1-C includes detailed information regarding USA and requirements for notifications.

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**APPENDIX 1-A**

**Cooperative Agreement with United States Forest Service  
Fire Suppression**

- (A) The State agrees that:
- (1) In the case of fires for which the employees of the State are responsible:
    - (a) Immediate action will be taken by the available personnel of the State to suppress the fire.
    - (b) Responsible transportation officers will immediately report such fires to the nearest designated and/or agreed upon Forest Officer.
    - (c) The expense of labor, supplies and equipment contributed by the State in suppressing such fires will not be a charge against the Forest Service.
  - (2) In the case of fires for which the construction contractors of the State may or may not be responsible:
    - (a) Responsible transportation officers will immediately report such fires to the nearest designated and/or agreed upon Forest Officer.
    - (b) The subsequent action, liability of, or settlement with, the contractor and his or her forces shall be made, ordered, determined and arranged by the Forest Service. The State does not assume or accept responsibility and/or liability for the actions of contractors and their forces.
  - (3) In the case of fires for which the employees of the State are not responsible, originating on or adjacent to the right of way of State highways, maintained by day labor construction or State maintenance crews:
    - (a) Employees of the State will be instructed to take initial suppression action and to report such fires promptly to the nearest designated Forest Officer.
    - (b) Such fires will be handled by the available forces of the State until the arrival of the Forest Officer.

- (c) All expenses for the suppression of such fires will be borne by the Forest Service. Reimbursement to be made directly to the State and not to its employees.

Note: It is understood that reimbursement will be made at the current fire fighting rates for wages and equipment.

- (4) Employees of the State will be required to obey all of the State and county fire prevention laws. Written instructions to this effect will be issued annually to all employees working in National Forest areas, and copies of this cooperative agreement will be given to all supervisory personnel working in National Forest areas.
- (5) The State agrees to stop, shut down or curtail dangerous operations involving burning, blasting, tar pots for patching, welding or other activities involving use of fire during periods of bad fire weather as determined by responsible Forest Officers. Or agreement to carry on such operations in a manner mutually agreed upon by the State highway officials and Forest Officers in charge of the given area.
- (6) Appropriate fire warning signs furnished by the Forest Service will be posted at all day labor camps established by the State or its contractors.
- (7) The State will notify Forest Supervisors in advance of any major job being undertaken within the National Forest protection boundaries either by the State or by contract. Both parties will get together prior to starting construction jobs or submitting bid specifications to contractors and agree to the necessary fire prevention measures to be taken so provisions can be made for enforcement and compliance.
- (8) Appropriate stipulations as determined in clause 7 above will be inserted in contracts or subcontracts entered into by and between the State and others for the construction of public works within the National Forest protection boundaries.

This is to facilitate compliance with the provisions of permits issued by the Forest Service and to prevent forest fires from starting from all operations which might endanger the National Forests. The State does not assume or accept responsibility and/or liability of contractors for the actions of any persons, contractors and their forces by virtue of any clause inserted in a contract to comply with the above.

- (9) The State will maintain at the site of construction jobs at all times during the fire season adequate fire tool caches, sealed and maintained for fire use only. The number of each kind of fire tool required in each particular case will be agreed upon with the Forest Officer having charge of fire control in the given area. The State will provide in contracts that all its contractors do likewise.
  - (10) The State will make its equipment available for rental to the Forest Service for fire suppression use whenever utilization of State highway equipment for such purpose will not result in closing down major day labor operations for extended periods. Reimbursement is to be made for such use to the State at its current rates of use.
- (B) The Forest Service agrees that:
- (1) Designated Forest Officers will proceed upon notification, to take charge of all fires occurring in or adjacent to right of ways or construction camps of the State.
  - (2) The designated Forest Officer will take charge of such fires unless notification is received that the fire being handled by the State has been completely and properly suppressed. In all such cases, the fire will be inspected by a responsible Forest Officer to make certain the fire is out.
  - (3) The supervisor of each National Forest will furnish a map of his or her forest to the Caltrans District Director. The forest's protection boundary will be clearly marked.
- (C) It is mutually agreed that:
- (1) In requesting services of employees of the State, Forest Officers will exercise due consideration for the necessity and importance to traffic of the work of the State.
  - (2) During the fire season as established for the locality, the employees or agents of the State will secure burning, blasting, and welding permits from the Forest Officers, responsible for fire control measures for the area. These permits will be obtained before proceeding with the disposal by burning of brush or other refuse, or blasting, or welding in connection with the operations of the State.

- (3) The State, through its local representatives, will participate with local Forest Officers in an annual hazard survey along State highways in or adjacent to the National Forests and will prepare a hazard reduction plan for those areas where studies show this is necessary as a fire prevention measure.  
The local Department of Transportation representative will then submit his or her recommendation based on the survey to the Maintenance Program Manager for consideration in the annual budget.
- (4) The State will do hazard reduction work each spring as set forth in the joint hazard reduction plan insofar as funds and personnel are made available.
- (5) For those areas where the State cannot handle the necessary hazard reduction as planned and the Forest Service can do the work, the State and the Forest Service may enter into a cooperative agreement where the Forest Service will do the work with the money made available in a cooperative work fund by the State.
- (6) The State and the Forest Service shall not be bound to make any expenditure under the terms of this agreement except as funds are appropriated by the State Legislature of California or by the Congress of the United States or which may be otherwise made available.
- (7) No member of or delegate to Congress or Resident Commissioner shall be admitted to (any) share or part of this agreement or to any benefit to arise there from unless it is made with a corporation for its general benefit.

This agreement may be terminated at any time or provisions herein contained may be amended or modified, upon mutual consent of the parties hereto.

**APPENDIX 1-B**

**Cooperative Agreement with California Department of Forestry  
Fire Suppression**

During times of fire or other emergencies, the California Department of Forestry (CDF) may request Caltrans assistance to provide support such as Caltrans personnel to provide equipment, and materials.

Therefore, for fires or other emergency incidents in areas where CDF provides direct fire protection, it is mutually agreed that:

- (A) In the event that fires are detected within or immediately adjacent to the highway right of way, Caltrans will report such fires to CDF and, to the extent Caltrans forces are immediately available, Caltrans will take initial action to suppress such fires until the arrival of CDF forces.
- (B) In the case of fires which occur as a result of work performed by Caltrans employees:
  - (1) Immediate suppression action will be taken.
  - (2) Responsible Caltrans personnel will immediately report such fires to the nearest CDF Emergency Command Center.
  - (3) The expense of labor, supplies, and equipment contributed by Caltrans in suppressing such fires will not be a charge against CDF.
- (C) In the case of fires which occur as a result of work performed by Caltrans construction or maintenance contractors:
  - (1) Responsible Caltrans personnel or contractor's representative will immediately report such fires to the nearest CDF Emergency Command Center.
  - (2) Any action, determination of liability, or settlement between CDF and a Caltrans contractor will be independent, separate, and apart from the rights and duties of Caltrans and its construction or maintenance contractors under the terms of their respective agreements with Caltrans. Caltrans assumes no responsibility or liability for fires that result from the work of its contractors and their employees and subcontractors.

- (D) CDF will take charge of all fires or other emergency incidents occurring in or adjacent to highway right of ways within CDF direct fire protection areas. The designated CDF officer will take charge of such fires or emergency incidents until the fire has been completely and properly suppressed or the emergency has ended.
- (E) Upon request by CDF to responsible Caltrans personnel, Caltrans may provide support assistance during times of fire or other emergency. Such support assistance may include equipment, transportation, repair work, etc., but will not include actual fire suppression work on the fire line, except when ordered by the Governor.
- (F) Caltrans will continue to maintain reduced vegetative fuel loads along right of ways and median strips to reduce the chance of a wildfire starting.
- (G) Except for the costs of immediate work performed by Caltrans to initially suppress fires that are the direct result of work by Caltrans forces, CDF agrees to reimburse Caltrans for all other labor, equipment, and material costs incurred by Caltrans in providing support assistance to CDF. All such costs shall be calculated in accordance with Section 8752 of the State Administrative Manual.

This agreement may be terminated at any time or provisions herein contained may be amended or modified, upon mutual consent of the parties hereto.

## **APPENDIX 1-C**

### **Instructions for Use of Underground Service Alert (USA)**

USA is a free notification service for persons who plan to dig, blast, trench, drill, or conduct any other underground excavation project that has the potential to disturb underground pipelines or utilities. USA will identify if there are utilities or pipelines underground in the area of planned work.

#### **(A) How USA Works**

The person planning an excavation calls USA at least 2 days in advance of planned work. A USA operator will take the location request information, verify the location, and send it to all USA members that may be involved at the proposed excavation site.

The USA members that are notified will check their records to determine if they have underground facilities at the site.

The caller will be advised by telephone that the USA member does not have facilities at the excavation site.

If a USA member does have facilities at the site, one of its employees will respond to the caller. The employee will provide information about the member's facilities, or will stake and mark the horizontal path of the facilities.

#### **(B) Advance Notice**

The Underground Service Alert Center is designed for planned work operations.

Each location request is good for a period of 14 calendar days. Contact USA at least two (2) working days prior to the start of actual work operations, between 7:30 a.m. and 4:30 p.m., Monday through Friday, excluding weekends and holidays.

The telephone number of USA is (800) 642-2444.

USA Holidays include the following:

New Year's Day  
Washington's Birthday  
Memorial Day  
Independence Day  
Labor Day  
Thanksgiving Day (and the Friday after)  
Christmas Eve after 11:00 a.m.  
Christmas Day

**(C) Emergency Excavations**

Emergencies during normal working hours of the Center will be processed as promptly as possible. Emergencies after hours should be called directly to the organizations whose facilities are involved.

**(D) USA Northern California Service Area**

Underground Service Alert (USA)  
4090 Nelson Avenue, Suite A  
Concord, CA 94520  
(415) 798-9504

The Northern Service Area includes the following counties:

Kern	Alameda	Napa	Shasta
Kings	Alpine	Nevada	Sierra
Lake	Amador	Placer	Siskiyou
Lassen	Butte	Plumas	Solano
Madera	Calaveras	Sacramento	Sonoma
Marin	Colusa	San Benito	Stanislaus
Mariposa	Contra Costa	San Francisco	Sutter
Mendocino	Del Norte	San Joaquin	Tehama
Merced	El Dorado	San Luis Obispo	Trinity
Modoc	Fresno	San Mateo	Tuolumne
Mono	Glenn	Santa Clara	Yolo
Monterey	Humboldt	Santa Cruz	Yuba

- (E) USA Southern California Service Area  
Underground Service Alert (USA)  
(800) 422-4133

The Southern Service Area includes the following counties:

Imperial	Orange	San Bernardino
Inyo	Riverside	San Diego
Los Angeles	Santa Barbara	Ventura

- (F) Color Code for Excavations

Paint outline of proposed excavation area with white dotted line.

- (G) Color Code and Symbols Used by USA Members

The following matrix indicates the color code and symbols used by USA members.

Contact USA directly with any questions regarding the color coding system or symbols used by USA members.

**USA Color Codes and Symbols**

<b>Color</b>	<b>Symbol</b>	<b>Type of Facility</b>
Blue	W	Water
Blue	FA	Fire Alarm
Blue	Tel	Telephone
Orange	R	Railroad
Orange	TV	Television
Orange	WU	Western Union
Green	S	Sewer
Green	D	Storm Drain
Green	L	Street Lighting
Red	E	Electric
Red	T	Traffic Signals
Yellow	G	Gas
Co. Name		Oil & Chemical

# CHAPTER 2

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Original signed by  
Dalean Colindres  
Office of Budgets and Planning  
Division of Maintenance

## **2.00 Introduction**

Resource Management in the Maintenance Program requires effective coordination among the many participants in implementing Program policies. This chapter outlines and describes the individual resource management responsibilities within the Maintenance Program. It also attempts to provide an overview of the necessary steps an individual must follow to ensure effective management of resources.

### **2.01 Roles and Responsibilities**

This section provides general information regarding the responsibilities of key participants involved in the management of Maintenance Program resources. Specific details are noted throughout this chapter.

#### **(A) Chief, Division of Maintenance**

The Maintenance Division Chief has overall responsibility for the statewide Maintenance Program. Specific resource management responsibilities include:

- (1) Developing and/or updating the Maintenance Program Business Plan, Program Evaluation Criteria, and Budget Change Proposals.
- (2) Establishing Level of Service goals consistent with available resources.
- (3) Developing justification for and maintaining documentation of Program resource needs.
- (4) Determining Maintenance Program resource allocations among the districts.
- (5) Evaluating Program effectiveness and redirecting Program resources as necessary to optimize the maintenance and preservation of the highways.
- (6) Working with the Division of Budgets on budget policy.
- (7) Presenting and justifying Maintenance Program resource needs to the Business Transportation & Housing Agency, Department of Finance, and Legislative Analyst Office.
- (8) Establishing Program goals and objectives within authorized resources.

**(B) Maintenance Division Office Chiefs**

Each of the Maintenance Division Office Chiefs have overall responsibility for the Maintenance “Families” assigned to their office. Specific resource management responsibilities include:

- (1) Recommending maintenance goals, objectives and performance targets for which the Office Chief is responsible, that will allow the Maintenance Program to achieve the goals of the current Business Plan.
- (2) Make recommendations regarding the optimal allocation of resources between districts.
- (3) Review district work plans, spending plans, and Level of Service (LOS) contracts.
- (4) Provide ongoing consultation to the Division Chief and the districts.
- (5) Evaluate district and program wide performance relative to the Program Business Plan, goals, objectives, and provide recommendations for changes necessary to meet the agreed upon goals and objectives.

**(C) Deputy District Director, Maintenance**

The Deputy District Directors, Maintenance responsibilities for resource management include:

- (1) Review of the Maintenance Program Business Plan, LOS contract, and resource allocation, and updating the district plan to achieve the expected goals and objectives within the budgeted resources.
- (2) Allocate personal service dollars, PYs (person years), and OE (operating expenses) including contracting resources within the district/regions, and reviewing regional work plans to assure conformance with district and Program goals and objectives.
- (3) Review and approve region work plans.
- (4) Evaluate equipment availability for impact on district work plans.
- (5) Plan for efficient utilization of equipment.
- (6) Manage staffing levels within approved Maintenance staffing plans and goals.

- (7) Manage, monitor, and evaluate work plan progress, LOS results, resource utilization, and take corrective actions as necessary to attain goals and objectives.
- (8) Submit Quarterly Spending Plans to keep the Chief, Division of Maintenance appraised of progress and resource utilization, and communicate needs for changes in resources and/or changes in work outcome.
- (9) Schedule and coordinate district maintenance work to be done by contract.
- (10) Evaluate production, LOS, and expenditures compared to work plan and reallocating resources or requesting a change in resources to meet the work plan.
- (11) Provide information regarding district issues, and associated resource management impacts to the Maintenance Division Office Chiefs and Chief, Division of Maintenance.
- (12) Provide information regarding Program resource management issues to District Resource Management Office.
- (13) Provide district perspective to Chief, Division of Maintenance regarding various Program issues.

**(D) Maintenance Division District Liaisons**

Each Maintenance Program District Liaison has the following specific resource management responsibilities:

- (1) Recommend and define Levels of Service.
- (2) Recommend Maintenance Program targets for each district per approved budget.
- (3) Review district's annual work plans, business plans and spending plans.
- (4) Evaluate district's performance in meeting established Levels of Service for each Program.
- (5) Monitor district's spending plan, and recommend approval, rejection, or revision to the Deputy District Director, Maintenance, and propose corrective actions to the Office Chief and Chief, Division of Maintenance.
- (6) Conducting field reviews to evaluate Levels of Service, use of proper methods and materials, and conformance with Maintenance Program policies and procedures.

## **2.02 Budget Overview**

### **2.02.1 Taxes, Fees and other Revenue Sources**

The primary source of revenue used in Caltrans is the gasoline tax. This supplies the vast majority of State funds used in Maintenance, and Caltrans as a whole. In addition, Caltrans (and Maintenance) resources are provided from truck weight fees, and reimbursements from local agencies and the federal government for work performed for these agencies. Caltrans used to receive bridge tolls directly, but now receive them in the form of reimbursements from the Bay Area Toll Authority (BATA), a local agency established to manage toll revenues.

### **2.02.2 Fund Sources**

A “fund” is similar to a bank account that accumulates dollars from revenue sources like taxes and fees. Nearly all of the Maintenance Program’s resources come from one fund source, the State Highway Account (SHA). The SHA is where most of the gasoline taxes and other fees are collected before they are provided to Caltrans and other departments to perform work.

Other fund sources in the Maintenance Program are federal funds (almost exclusively for bridge inspections) and reimbursements, which represent payments from local agencies for work performed by the Maintenance Program for local agencies.

A department can not use resources from any fund source unless the Legislature approves an appropriation for the use of the funds.

### **2.02.3 Appropriations**

An appropriation is the authority from the Legislature to use State resources to complete authorized workload. The Maintenance Program receives two (2) appropriations. The primary appropriation is called the “Main Appropriation Item” and provides the resources for the vast majority of the Maintenance Program workload, with the exception of Stormwater activities. The second appropriation is specifically for Stormwater activities. Resources in the Main Appropriation Item cannot be used for Stormwater, and vice versa, without the approval of the Department of Finance and the Legislature.

### **2.02.4 Types of Resources**

The Maintenance Program budget is organized into personal services dollars and person years (PY) to account for State forces labor expenditures, and operating expenses to account for the purchase of goods and services.

Personal services dollars represent the dollars expended for all categories of State forces labor. State forces labor categories include regular, temporary help, cash overtime (COT), and compensating time off (CTO). (Contract labor is accounted for as an operating expense).

A PY is the equivalent of 1,758 hours of productive work, and is used in calculations of workload when estimating personnel needs and costs.

PY's are budgeted and expended for regular and temporary help categories. Although there are no formally budgeted PY's for cash overtime, the Department does track expenditures of cash overtime PYE (personnel year equivalent) to assist in managing cash overtime resources.

Because all positions are not filled at all times, a position is assumed to expend 95% of a PY on average to take account of turnover and the time required to fill a vacant position (this is called the "vacancy factor" or "salary savings").

Operating expenses (OE) consists of contracts, equipment, materials, agreements with other agencies, utilities, facilities expenditures, travel, communications, and other expenditures for goods and services the Maintenance Program purchases. These expenditures are tracked in Categories and Object Codes which are associated with particular goods and services that are purchased.

#### 2.02.5            The Budget Process

The State of California budget cycle is measured in "fiscal years" which begin July 1 of each year, and end on June 30 of the following year. Caltrans begins planning for each fiscal year's budget one-and-a-half years before the beginning of the fiscal year. For example, for Fiscal Year 2005-2006, which began July 1, 2005, the budget process began in January 2004 with the development of the Department's strategic plan and goals.

The Budget Change Proposal (BCP) is the main document that the Maintenance Program and all other programs use to request increases to the Program budget. These BCP requests are usually for new inventory or new workload not previously funded. Shortly after the establishment of the Department's overall strategic direction and goals, the programs begin developing BCP's for resources to complete new workload.

Each BCP is reviewed internally by the Department. If the Department approves the BCP, it is sent to a variety of external control agencies before it is approved and made part of the Maintenance Program's budget. These external control agencies are: The Business, Transportation and Housing Agency (which ensures that the Department's proposal is consistent with the Administration's goals), the Department of Finance (the Administration's budgetary watchdog), the Legislative Analysts' Office (the Legislature's budgetary watchdog), and the Legislature itself. If a proposal receives the approval of all of these external agencies, it becomes part of the approved Budget Act, and the resources can be used by the Maintenance Program. This review process takes approximately one (1) year from initial approval by the Department to final approval by the Legislature.

### 2.02.6 Budget Terminology

**Program :** A program (such as the Maintenance Program) is a group of activities or projects designed to achieve a common purpose. For instance, the various activities (Family Problems) of the Maintenance Program, taken together, are performed to achieve the common purpose of maintaining of the highway system.

**Expenditure Authorization (EA):** An accounting code used to represent a particular activity or project. Each activity is tied to a particular program so that when that EA is used for an expenditure of labor or operating expense, that expenditure is charged against the program associated with the EA.

**Maintenance Programs and Families :** Maintenance has historically grouped the Program's activities into sub-programs designated as "HM" programs, which correspond to the formal budgetary program codes. These programs and codes are shown below:

Program	Description	Budgetary Code
HM1	Travelway	2080010
HM2	Roadside and Drainage	2080020
HM3	Bridges and Other Structures	2080030
HM4	Electrical and Traffic Guidance	2080040
HM5	Support and Training	2080050
HM6	Snow and Storm	2080060
HM7	Radio Communications	2080070

Each Maintenance sub-program is made up of groups of activities called "Families." For example, the HM1 Program for travelway is made up of the "A" Family (flexible pavement) and the "B" Family (rigid pavement).

## 2.03 Allocations and Controls

The Maintenance Program allocations are simplified to allow each district the most flexibility available to manage their resources. Specific operating expense allocations are made for travel, utilities, MAZEPP, Major Maintenance, MPYE contracts, and Fleet Equipment. These are controlled categories. All other allocations are included in the "Block Grant." Districts have the authority to use Block Grant resources as necessary to achieve district goals and objectives. Districts need Chief, Division of Maintenance approval to change the amounts in the controlled operating expense categories.

The Maintenance Program allocates personal services dollars and PY's for Regular, Temporary Help, and Cash Overtime categories. These allocations cannot be changed without approval of the Chief, Division of Maintenance.

Allocation adjustments are requested via Allocation Change Requests (ACR's). Districts requesting changes to their allocations need to submit an ACR approved by the Deputy District Director, Maintenance and the District Budget Officer. If the Chief, Division of Maintenance approves the ACR, it will be submitted to the Division of Budgets for formal entry into the Department's Allocation File.

#### 2.03.1 Monitoring and Spending Plans

Each month, the Deputy District Director, Maintenance will review the expenditures to date and compare these to the spending plan to date. Based on this, work schedules should be adjusted as conditions permit to accomplish the approved spending plan.

Quarterly Spending Plans will be completed by each district and submitted to the Chief, Division of Maintenance for review and approval. Spending plans may be required monthly during the last four months of the year to ensure best usage of Maintenance Program resources.

If, for any reason, allocated resources cannot be fully expended, the Chief, Division of Maintenance must be notified of any resources which will not be utilized for the purpose they were allocated so consideration can be given to redirecting the resources to the Program's advantage. If projections based on expenditures and planned workload indicate that any allocated resource level will be exceeded before the end of the fiscal year, immediate corrective action should be taken by the district to get back on target.

Districts shall not overrun their annual Maintenance Program allocation. Increased resource needs are to be reviewed by the Chief, Division of Maintenance. No action shall be taken that would result in an allocation overrun without the Chief, Division of Maintenance written approval. When appropriate, the Chief, Division of Maintenance will obtain approval for budget deviations from the Division of Budgets.

Program allocations are reviewed annually utilizing the Maintenance Program Budget Model. Work load which cannot be accomplished at the agreed Level of Service (LOS) within current allocation levels should be brought to the attention of the Chief, Division of Maintenance for policy review and possible revision to the activity's (LOS).

Changes to the Maintenance Program's annual budget allocation must be reviewed and approved by the Division of Budgets, who will also determine if Legislative concurrence is required.

### 2.03.2 Budget Allocation Adjustments

If a Budget Allocation Adjustment need is identified, the Deputy District Director, Maintenance should consult with the District Budget Officer. The District Budget Officer can recommend options, and offer guidance regarding current budget policies and procedures.

### 2.03.3 Requests for Specific Expenditure Authorization

Requests for specific work other than Major Maintenance or normal State forces workload are submitted on an Expenditure Authorization Form (FA 47). These requests should clearly describe the work proposed, the location, and cost. The following data should also be included to ensure uniformity and facilitate review:

- (A) Post mile to post mile limits.
- (B) Description of work in sufficient detail to permit a clear understanding of what is intended.
- (C) Reference to any specific Budget Change Proposal.
- (D) Reference to applicable Standard Specifications or Maintenance Manual by section and paragraph. Describe special requirements in specification form.
- (E) Estimate of quantities and costs of the various items of work to be performed should, when possible, be set up in accordance with the pay unit basis indicated in the Standard Specifications.

When it is determined that no further expenditures will be made against the expenditure authorization, it should be closed by informing the District Project Control Officer.

### 2.03.4 Maintenance Stations

The District Director is authorized to approve HM funded repairs to Maintenance stations. Funds for needed repairs and upkeep at Maintenance stations are programmed in the same manner as other maintenance functions, and are to be included as a single lump sum in the annual budget.

New construction and improvements to existing stations are budgeted through the State Highway Operations & Performance Program (SHOPP), Maintenance Facilities, Land and Buildings Program (Code 201.352) for major projects, or through the annual Minor portion of the program for minor improvements.

## **2.04 Limitations and Use of Funds**

Following are particular restrictions to the expenditure of allotted funds. These items will be subject to Maintenance Program review.

- (A) Projects for repair and painting of bridges and tunnels (Families “H” and “J”) that are estimated to exceed \$42,000 at any one location are to be submitted to the Assistant Division Chief, Office of Structures Maintenance, for review and approval.
- (B) Major Maintenance is defined as any planned surface treatment or base repair estimated to cost \$60,000 or more, for a specific project, or several projects if they are adjacent and scheduled for the same treatment. These projects will be submitted to the Chief, Division of Maintenance for review by October 14th preceding the fiscal year in which the work is to be performed. Major Maintenance may be done by State forces or by contract. Person years and dollars for Major Maintenance are included in the district's approved HM Program budget.
- (C) Preliminary engineering and construction engineering will be charged to the appropriate Project Expenditure Authorization (5XX000) on Minor contracts that are financed from Maintenance funds.
- (D) Preliminary engineering and construction engineering on contracts over \$42,000 will be charged to a multiphase expenditure authorization (EA). Prior to starting the preliminary engineering, a Phase 1 EA must be submitted by the District Project Control Officer in accordance with the Accounting Coding Manual.
- (E) When the contract is awarded, a Phase 3 construction engineering and a Phase 4 contract EA will be issued by Headquarters.
- (F) Reimbursed Work for Other Agencies"926" Authorizations. (See Section 2.05).
- (G) Accommodation work may be performed for individuals, firms, or political subdivisions of the State. When the project includes reimbursement to the Department, the agreement must require a deposit in advance of performance sufficient to cover the reimbursed costs including overhead assessments.

The existing signals and lighting billing procedures currently allow the Department to bill in areas and will be subject to the advance requirement.

Work for a city or county may be arranged by cash deposit, special agreement, or Purchase Order. Work for other State agencies is usually authorized by execution of Form 13A, Interagency Service Agreement.

These agreements constitute contracts entered into by the Department of Transportation and the other agencies and as such, must be rigidly adhered to as to amount, type, extent of work to be performed, time limits, etc. No deviation from the terms of an Interagency Agreement is permitted without the approval of the contracting agency and the Department of Finance.

- (H) Projects for restoration, major rehabilitation or improvement to existing Maintenance station facilities, including Cal/OSHA safety improvements to buildings, are not financed from Maintenance (HM) funds. They are included in HA-1 Lands, Buildings, and Facilities Improvements. Likewise, the maintenance and repair of State-owned employee housing is included in HM-5 (20.80.050 Program).

## **2.05 Work for Others (Programs and Agencies)**

Work for Others is defined as any work performed under specific requests and authorizations by other offices; e.g., Traffic, Construction, Right of Way, Equipment, and others within the Department of Transportation. In addition, Work for Others includes work for other agencies such as the Department of Parks and Recreation, and State Institutions.

Refer to Maintenance Manual Volume 2, “Y” Family, regarding charging practices for Maintenance for activities contained in this section. Districts must have the budgetary authority to perform work for others. Contact the District Budget Manager to confirm such authority exists before performing workload.

### **(A) State Park Roads**

It is Caltrans policy to require the Department of Parks and Recreation to finance all work on roads in State parks, which are under their jurisdiction. While such work is not financed from State Highway Funds, it may be performed by our forces under authority of an annual Interagency Service Agreement (Standard Form 13A) and a covering general ledger 926 expenditure authorization. The work to be performed must conform to that authorized in the Interagency Agreement, and is to be restricted to the locations specified therein. Work is not to be undertaken without written request from the local Park Superintendent. Such requests will not require advance approval by Headquarters Maintenance Program. Agreements should be written specifying that routine patrol and surveillance activities are to be performed by the Department of Parks and Recreation. Written requests from the Park Superintendent should then outline the desired work and specify the expenditure authorized for it.

Such authorized expenditures are not to be exceeded without prior approval by the local Park agency. Also, the overall expenditure must not exceed funds allotted under the 926 expenditure authorization. Every effort should be made to expedite billings to the Department of Parks and Recreation to permit them to reallocate unexpended balances to other needed work.

**(B) Minor Improvement and Betterment Work**

Minor improvement or betterment work, while frequently performed by Maintenance forces, is under the control of the Construction Program. This work, which is classified as one of the "Construction" or "Capital Outlay" Programs, consists of minor construction of immediate necessity, including but not limited to such items as:

- (1) Improve grade or widen roadbed, including shoulder.
- (2) Correct sub-drainage, stabilize base, and import select materials on sections with poor base.
- (3) Improve sight distances.
- (4) Super elevate curves.
- (5) Serrate pavement to increase skid resistance.
- (6) Grind portland concrete cement (PCC) pavement.
- (7) Apply oil treatment and prepare roadway or shoulders for this treatment.
- (8) Extend old or install additional or larger capacity culverts.
- (9) Benching or flattening cut slopes in connection with slide or slip-out correction.
- (10) Improve bridge decks.
- (11) Install guardrail or other safety devices.
- (12) Place riprap, slope paving, etc., for erosion control or bank protection.
- (13) Installation of horizontal drains.
- (14) Installation of signs.

Total statewide funds for this program, are voted each year by the California Transportation Commission (CTC) as a lump sum item. This sum is apportioned to the twelve Transportation Districts by the Maintenance Program, on the basis of estimated annual needs. Approval of funding for projects has been delegated to the District Director for projects under \$ 120,000.

Requests for small projects or minor construction allotments to be performed under Day Labor and final reports thereon should be submitted in the form prescribed by the Division of Construction. The Day Labor law requires that a final report on work in excess of \$25,000 shall be filed within 60 days with the County Clerk in the county where the public work was performed. If the engineer maintains an office in the county where the work was performed, the report shall be filed in that office.

**(C) Work for the Office of Right of Way**

Any maintenance of leased properties or "Excess" or "Future Freeway" properties (inside or outside the fenced right of way) performed by Maintenance forces will be by specific request and an expenditure authorization from the Division of Right of Way. All other maintenance and all monitoring of properties will be charged to normal Maintenance EAs (5xxxxx). For additional details regarding monitoring and maintenance of non-operating property, refer to Chapter 13, Roadside Maintenance.

Non-operating right of way is property owned by the Department that is not actively used for highway purposes and is typically; excess land that has not yet been disposed of, land acquired for future highway purposes, or land within the highway right of way which can be utilized for other purposes, such as the leasing of airspace.

The Maintenance Program is not normally responsible for the maintenance of non-operating right of way, except for airspace lease property which is vacant (not rented).

Maintenance will be responsible for the maintenance of airspace property when not rented, and such maintenance will consist of all activities necessary to keep appearances acceptable, and which protect the structure which creates the space.

**(D) Final Reports on Contracts and Day Labor Work**

Final reports on all maintenance work and Day Labor work financed under Minor Improvement Betterment or other Construction funds are to follow the form prescribed by the controlling office.

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## **2.06 Contracts**

### **2.06.1 Processing Contracts**

#### **(A) Roles and Responsibilities**

Figure 2-3 illustrates the roles and responsibilities for each person involved in processing contracts, both major and minor, at either the district level, or from Headquarters.

Figure 2-3: Roles and Responsibilities

CONTRACT ACTIVITY	RESPONSIBLE PARTY
Determine project level and contract type	Deputy District Director, Maintenance
Initiate contract (minor); set EA	Deputy District Director, Maintenance
Obtain approval for contract (minor)	(Delegated to district)
Initiate contract (major); notify Headquarters	Deputy District Director, Maintenance
Obtain EA and masterfile in TRAMS to allow charging	Maintenance Program, District Project Control, Accounting Service Center
Advertise, if competitive bid	Maintenance Program, Division of Engineering Service, Office Engineer
Award contract	Maintenance Program
Certify funds	(Delegated to district)

#### **(B) Monitoring Contracts and Allocations**

All Maintenance contracts and contract allocations are monitored for compliance with Maintenance policy by Maintenance Program staff. Each contract is reviewed for concurrence with Maintenance Program responsibility, correct charging practices (EAs), and appropriate coding. Maintenance staff maintains a current status of all Maintenance contracts. They also coordinate the awarding of major contracts with Office Engineers (ESC).

#### 2.06.2            Delegated Maintenance

The districts have Delegated Maintenance Agreements with cities and counties. Under these agreements, the Department pays cities and counties to do certain delegated tasks for the Department.

There is a pre-approved, standardized format used for Delegated Maintenance Agreements.

Explanations for significant deviations from the standard form must accompany the approved agreement.

#### 2.06.3            Interagency Agreements

In cases where Caltrans policy requires services to be provided to other State institutions, Caltrans and the institution shall enter into an Interagency Agreement that provides funding back to Caltrans. Work is not to be performed without written request from the State institution to the Caltrans Contract Manager.

Agreements should be written to identify the responsive work required. When possible, work should be performed in coordination with normal routine activities. Responsive work shall be billed as stated in the agreement. The Interagency Agreement shall specify the expenditures authorized. These expenditures shall not be exceeded without prior approval by the State institution with which the agreement has been established. Every effort should be made to expedite billing to the State institution. Work for Others may be authorized by execution of Form 13A, Interagency Agreement, or by Service Contract Form 360 when contract is income generating.

Requests from the districts for additional supplemental or specific supplemental agreement capacity must be countersigned by the District Budget Officer as to availability of funds before being forwarded to the Maintenance Program. The Maintenance Program monitors and maintains the Delegated Maintenance Agreements with the State Controller's Office and Headquarters' Central Files. Although the District Director can approve specific Delegated Maintenance work, the district still must write a letter to the Maintenance Program that will be used to notify the State Controller's Office of the new agreement spending capacity.

#### 2.06.4            California Conservation Corps

Caltrans has entered into an Interagency Agreement with the California Conservation Corps (CCC) to accomplish useful and needed public works projects in both urban and rural areas. Districts can enter into a separate agreement with the California Conservation Corp for additional work using district funds.

2.06.5          Special Programs People

In addition to the annual agreement with the CCC, Caltrans also utilizes inmates and welfare recipients in highway Maintenance. The inmate/welfare recipient effort includes six kinds of workers. All of them volunteer for the assignment, and are screened by the appropriate agency before being allowed to work for Caltrans.

(A) Court Referrals

Commonly called "probationers", these are people sentenced by the court to do public service in lieu of serving time in jail. They usually work on weekends. They are expected to arrive at their assigned work place on their own and be ready for work.

(B) Work Furlough

These are people who have been sentenced to serve time in jail, but have been released from jail on their own recognizance. They live at home and check in with the Sheriff's Department by telephone or through attendance reports kept by Caltrans. They work on weekdays and on weekends. They are responsible for arriving at the work site on their own and being ready for work.

(C) Work Release

These are people who are serving time in jail. They volunteer for public service work, and are screened and instructed by the Sheriff's Department before being accepted for public service work. Caltrans typically transports these people from the jail to the work site, but the Sheriff's Department sometimes does this. They work primarily on weekdays.

(D) Inmate

These are people who are currently serving time in the State prison system. They are transported and supervised by a Correctional Officer. They work primarily on weekdays.

(E) Workfare

These are people who are receiving public assistance. They are required to do public service work to retain their benefits. They report to work on their own. They work primarily on weekdays.

(F) General Relief

These are people on county general relief. They are assigned to public service work in exchange for support. They are to report either to their work site, or to a predetermined assembly point for transport by Caltrans. These people generally work during the week.

**2.06.6 Landscaping Maintenance by Private Parties**

Cities or counties should first obtain concurrence from the District Maintenance management, and the District Landscape Architect prior to placement of a mitigating condition requiring private developers, as a condition of development of land parcels adjacent to highway right of way, to install and maintain landscaping within highway right of way.

In these situations, the duration of the landscape maintenance is usually a period of one (1) to 20 years. In some cases, when the landscaping is approved adjacent to controlled access right of way, locked gates may be requested to provide direct access from the development. This is accomplished through the encroachment permit exception process.

Generally, such requests may be coordinated under an encroachment permit, as an encroachment, or under a Maintenance Agreement, through the Deputy District Director, Maintenance.

**2.07 Use of Day Labor**

"Day Labor" is defined by State law as the construction of a capital improvement project by the use of casual labor or by State forces. To be considered Day Labor, work must be a new improvement to the infrastructure, or full repair of existing infrastructure. Work for the normal upkeep and maintenance of the infrastructure is not considered Day Labor.

It is the State's policy to contract for the performance of construction type projects, and to do so in full conformance with the State Contract Act. The State Contract Act prohibits the use of Day Labor in excess of \$25,000 unless at least one (1) out of four (4) criteria is met. (See DD-26R, effective 5/1/99). Three out of the four criteria involve emergencies of various kinds. The fourth criteria gives authority to the Director to use Day Labor if it is in the "best interests" of the State after plans, specifications, and estimates have been approved.

To determine if the \$25,000 threshold has been exceeded, the cost for Day Labor work includes labor, equipment, materials, and engineering or architectural services.

**2.07.1 Day Labor Procedures: Greater than \$25,000**

To assure compliance with State law and Departmental policy (see above section), Day Labor projects exceeding \$25,000 require a Director's Order approved by the Deputy District Director, Maintenance.

To determine if the \$25,000 threshold is exceeded, the cost for Day Labor work includes labor, equipment, materials, and engineering or architectural services.

All Day Labor projects in excess of \$25,000 require an approved Director's Order. Prior to initiating the work, the District Director submits a Director's Order Request to Headquarters Division of Maintenance.

If the Director's Order is approved, then the work may proceed. Follow the accounting and record-keeping requirements in the next section.

**2.07.2 Day Labor Procedures: Less Than \$25,000**

- (A) Authority for approval of the Day Labor work method and the expenditure authorization for work estimated to cost less than \$25,000 has been delegated to the District Directors. The District Project Control Officer will validate the coding and forward the EA to the Division of Financial Operations and Control.
- (B) After reprocessing by the Accounting Division, copies of EAs with questionable Day Labor work methods will be forwarded to the Division of Maintenance for review and recommendation.
- (C) Overruns of original estimates, not exceeding a total project cost of \$25,000, may be approved verbally by the District Director providing that the scope of character of the work is unchanged. Subsequently, this must be confirmed by a revised EA.

**2.07.3 Day Labor Record Keeping and Review: Greater than \$15,000.**

This section applies to all Day Labor costing more than \$15,000 for personnel, materials, equipment, and other expenses.

State law (Government Code 4000 et seq.) requires that the "engineer ... in the office of his or her district" keep records of all Day Labor projects worth more than \$15,000.

- (A) To facilitate review and control, each district shall maintain a file for each fiscal year containing copies of EAs for all Day Labor projects. The file will be kept up to date with each EA being entered as it is approved.

- (B) The Chief, Office of Roadway Maintenance, is responsible for the field review of a minimum of 25 percent of all Day Labor projects exceeding \$25,000 each year. This review is done for the purpose of confirming proper work method, extent of work performed, reasonableness of work performed, funds expended, and general district conformance to Departmental policy.
- (C) Plans and specifications with an approved EA, adequate to describe the work and serve as an estimate, must be on file in the district office prior to starting work on projects costing more than \$15,000.
- (D) Final completion reports (use of STD Form CEM 6301 is acceptable) are required within 60 days following completion of work for all Day Labor projects, except those occasioned by emergency, and those costing less than \$15,000. The reports must segregate the project cost by labor, equipment, materials, and engineering costs. State law (Government Code 4005) requires segregated final reports.

## **2.08 Storm Damage and Other Major Damage; Disasters**

Storm damage, or major damage due to other causes, can vary in scope from routine cleanup and patrol, to major disasters when Maintenance incurs millions of dollars in costs.

Storm Damage and other Major Damage consists of:

- "Emergency Opening" work at the scene of a damaged facility due to natural disasters, storms, earthquakes, landslides, flooding, tsunami, terrorism or other sudden events. Often includes traffic control, debris removal, and temporary repairs sufficient to reopen the facility.
- Permanent repairs to restore the facility to its pre-disaster condition.
- Patrolling highways following storms, earthquakes, etc. to check for damage or unsafe conditions.

Storm damage and other damage is fully described in Chapter "S" of this manual. See Maintenance Manual Volume 2, Chapter "S" for storm damage and major damage charging practice instructions. The following sections summarize storm damage and other major damage as it applies to resource management in Maintenance.

### 2.08.1 Charging Practices and Cost Recovery

Following established charging practices for storm damage and other major damage is critical to ensure the department maximizes potential State and federal damage assistance. State and Federal reimbursements are dependent on conforming to federal audit and accounting standards. Failure to comply with reporting and cost standards can either cause loss of federal eligibility during an incident or repayment of reimbursement in a post-disaster audit.

### 2.08.2 Basic Federal Cost Principles

Cost principles that underlie all federal damage assistance to public agencies derives from the Federal Office of Management and Budget's Circular A-87, "Cost Principles for State, Local, and Indian Tribal Governments." Essentially these principles are:

- **Costs Must Be Allocable.** This means that costs must be recorded in a way that allows costs to be broken down by each project site or damage location. Assigning individual EAs or IMMS Work Orders by each damage site is allocable. Assigning multiple damage sites into a "lump sum" EA or Work Order is not allocable.
- **Be Adequately Documented.** Records of locations, the work performed, extent of damage, and photographs are stored or archived to demonstrate the eligible work was performed.
- **Be Necessary and Reasonable.** The work must be needed and necessary (in other words, repairs to undamaged facilities are not allowable). The costs must be reasonable (roughly in line with costs the open market would pay).

Therefore, when proceeding with storm damage or other major damage work, Maintenance does the following:

#### Damage Spot Locations with Total Costs \$1,000 or More

- **Work by State Forces:** Separate IMMS Work Orders are set up, site specific Project Numbers are assigned, and costs recorded.
- **Work by Contractor:** The district either establishes separate contracts and EAs for each damage site OR, if multiple sites under one contract, uses Special Designations or Subjobs to keep costs segregated by damage location.

Continuous Damage Locations of \$15,000 per Mile or more

The requirement for separate Work Orders or EAs does not apply to "continuous damage." Example: water runs longitudinally along a shoulder and causes step-off erosion at many intermittent locations over three miles. Since the scope of work is identical at each intermittent spot, and the repairs can be accomplished as one operation, this example can be considered "continuous damage" and may be handled under one Work Order or EA. For work performed by Maintenance forces, the use of an IMMS Project Number is required for continuous damage sites.

2.08.3           Types of Damage Assistance

- A. **Federal Major Disaster:** If the President declares a major disaster, usually by county, reimbursement for damage costs for cleanup and repair are usually made available under the Federal Highway Administration's Emergency Relief (FHWA ER) Program, or the Federal Emergency Management Agency's (FEMA) Stafford Act. In the past, both Maintenance costs and capital construction contract costs have received millions of dollars of aid under these programs. If a major disaster is declared, adhering to the cost principles under 2.07.2 are critical.

In the event of a federal disaster, districts can expect to receive instructions for special cost coding to be used. Generally, these instructions include IMMS Project Numbers and/or Special Designations.

For Maintenance costs eligible for ER reimbursement, the process used is:

1. Maintenance responds to damage locations, all reported under IMMS Work Orders. Disaster-related Work Orders use a designated Project Number.
2. The District Maintenance Engineer identifies eligible sites and prepares Damage Assessment Forms (DAFs). Each IMMS Work Order is correlated with the matching DAF. Cost Reports for each Work Order are printed out and attached to the DAF as back up for the claimed costs.
3. DAFs are signed by FHWA. Copies are submitted to the Headquarters Major Damage Engineer in Maintenance, and to the Federal Resources Area Engineer in Headquarters Budgets.
4. Federal Resources creates Federal Project Numbers in the FHWA Federal Aid System (FADS). The Major Damage Engineer submits IMMS data, a list of DAFs, and Federal Project Numbers to Accounting.
5. Accounting creates "dummy" federalized EAs. Eligible Maintenance costs from the DAFs are transferred from the Maintenance EA to the dummy EA, where it is submitted electronically to FADS for reimbursement.

6. Maintenance Resource Management works with Budgets to prepare a request for a budget change to obtain increased budget capacity to receive the federal aid.
  7. For some (but not all) disasters, use of Form 42 paving projects is approved. These projects perform certain pavement repairs in disaster areas that would otherwise be ineligible for FHWA assistance. Typically, the ER reimbursement to Maintenance is used to fund Form 42 projects.
- B. **Gubernatorial Disaster:** In some disasters, the Governor may declare an emergency, but the President does not. The FHWA Administrator may activate the ER program administratively at his or her discretion. FEMA Stafford Act will not be available. In any case, the cost principles under 2.07.2 still apply.
- C. **Major Damage, No Disaster:** If the event causes more than \$750,000, and there is no disaster declared, the Department normally seeks to federalize the project using "regular" federal matching funds. In this case, only a capital construction contract and the capital support can be federalized. Maintenance costs cannot be federalized (as of 2003).

## 2.09      **Damage Repairs and Cost Records`**

Records should be maintained by the district to distinguish disaster and storm damage repairs from accident and vandalism damage work.

### 2.09.1              Damage to State Projects

Repair of damage to State projects (except State owned employee housing) will be charged to the appropriate Maintenance Family/Problem and method using damage report numbers as a Special Designation when the cost does not exceed \$25,000.

Repair work costing more than \$25,000 will be reported by a specific expenditure authorization.

Requests for expenditure authorizations to repair such damages will include all pertinent information such as the damage claim number, the damaging party (if known), location, and extent of damages.

During progress of specific work, a record of costs shall be kept in the manner and form prescribed under current accounting instructions. Completion reports on maintenance work will not be required when financed wholly from Maintenance funds. Completion reports will be required when all or any part of the cost is to be recovered, either from responsible party or parties on a damage repair or an agency participating in the cost of the repairs or replacements.

## **2.10 Materials and Supplies**

### **2.10.1 Acquiring Materials and Supplies**

It is the policy of Caltrans to maintain inventory control and accountability of all material until such items are put into use. All materials and supplies, except those that must be obtained by Sub-Purchase Order, for immediate use, should be accounted through district office in accordance with current accounting instructions. Materials and supplies are withdrawn from the Warehouse inventory using a Local Request.

They should also be shown on an Integrated Maintenance Management System (IMMS) Work Order under the correct Activity. Material should be charged out in IMMS the same day the material is used.

### **2.10.2 Criteria for Ordering Supplies**

Every Division and district has established criteria for determining who may order supplies, equipment, furniture and other commodities, and who may approve requests within the Division or district.

Goods may be ordered by the following methods listed in priority use order:

- (A) LR-EDPs (Local Request-Electronic Data Processing) for supplies from a Caltrans warehouse.
- (B) Supply Orders for supplies from Department of General Services (DGS) Stores.
- (C) Purchase Requests.
- (D) Purchases using an assigned Caltrans Credit Card (CALCARD).

Refer to the “Acquisition of Materiel Manual” for information and instructions for the use of each of the four methods of purchase.

### **2.10.3 Product Endorsement Prohibition**

No employee shall endorse commercial products by stating that such items have been adopted by the State, or that certain articles are superior to others, without the approval from the Maintenance Program. The Division of Procurement and Contracts has been delegated the task of investigating all merchandise to be purchased, and will represent the Department of Transportation in relations with vendors. All matters pertaining to specifications and procurement of materials will be referred to the Division of Procurement and Contracts.

# CHAPTER 3

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This chapter is divided into two sections. The first section provides an introduction, which includes the purpose of the chapter and instructions for its use. The second section is an alphabetical listing of California Codes that impact Maintenance operations.

Not all laws that impact Maintenance operations are listed in this chapter. Other chapters in this manual may contain information regarding legal requirements not included here. Where appropriate, there is reference to chapters within the Maintenance Manual and other Caltrans guidance documents.

Original signed by  
Jeanne Scherer  
Legal Division

### 3.00 Introduction

The following summary of laws is provided as a general reference for Caltrans Maintenance personnel. The purpose of this chapter is to bring attention to some codes that impact Maintenance operations. If questions arise concerning the application of these laws, the actual code sections should be consulted. Employees should not rely solely on the unofficial abridgments contained here.

A publication entitled “Statutes Relating to the California Department of Transportation” is revised and published after each regular session of the Legislature. Employees should familiarize themselves with laws as they relate to their own particular branch of work. Districts should consult the Legal Division for advice or guidance regarding interpretation of specific statutes.

It is important that field Maintenance personnel have knowledge of the laws relating to their work. Employees who become aware of violations of the law shall immediately notify their supervisors or a law enforcement officer. At no time shall a Caltrans Maintenance employee put himself or herself in personal danger to prevent violation of a statute.

\*\*\*\*\*

The following abbreviations for California Codes have been used in this document:

F&AC	Food and Agriculture Code
B&PC	Business and Professions Code
GC	Government Code
H&SC	Health and Safety Code
LC	Labor Code
PC	Penal Code
CC	Civil Code
S&HC	Streets and Highways Code
VC	Vehicle Code
PCC	Public Contract Code
PRC	Public Resources Code
PUC	Public Utilities Code

The following abbreviations for Federal Codes have been used in this document:

USC	United States Code
CFR	Code of Federal Regulations

The following table lists the subjects covered by various statutes that are listed in the next section:

Table – Index of Subjects Listed in Section II	
Abandoned or Disabled Vehicles, Removal of	Liability of Public Employees
Accident Reports Required	License Requirements
Animal Carcasses	Litter
Chains (Tire) Required	Livestock on Highways
Civil Liability and Financial Responsibility	Load Limits
Clean Water Act	Maintenance, Definition of General Provisions
Closing Highways	No Passing Zones
Closing Highways, Notice of	National Pollution Discharge Elimination System
Closing State Highways	Parking Regulations
Closing Street or Highway	Permits to Governmental Units
Contracting, Constraints and Requirements	Personal Service Contracts
Contracts, Day Labor	Pests on Highways
Contracts, Day Labor Limits	Poles Within Freeways
Curb Markings to Indicate Parking Regulations	Poles, Telephone and Telegraph
Damage to Highways or Bridges	Project
Damage to Highway or Bridge, Liability for	Protection of Public Utilities
Damage to Highway by Water	Public Officers and Employees Must Obey VC
Damage to Signs, Barricades, Lights	Removal or Breaking Barriers, Signs and Lights
Damage to or Removal of Trees, Shrubs, Etc.	Rubbish - Vehicles - Cover for load
Detours	Safety Orders
Drainage or Impounding of Water	Safety Devices and Safeguards
Dumping on Highway	School - Markings and Crosswalks
Encroachment Permits	Selling on Right of Way Prohibited
Encroachments, Removal of	Signs
Equipment, Highway	Speed Limit Zones
Equipment, Snow Removal	Spilling Loads on Highway Prohibited
Explosives, Transportation of	Standardized Emergency Management System (SEMS)
Ferry Connections	State Parks, Highways In
Fire Fighting	Stock Trails
Flags	Survey Monuments, Perpetuation of
Franchise in State Highways	Traffic
Freeway	Traffic Direction
Glass, Nails, Etc., Placing on Highway	Unauthorized Signs, Signal and Lights
Historical Landmarks	Warning Signs, Lights, and Devices for Highway Work
Injured Persons	Water
Landscaped Freeway	Weighing
Leasing of Equipment	Weight Limits
Length of Vehicles, Maximum Permitted	Width of Vehicles, Maximum permitted

Figure 3-1 Table – Index of Subjects Listed in Section II

### **3.01 Codes**

#### **Abandoned or Disabled Vehicles, Removal of: VC 22650-22651 , VC 22654**

Any peace officer or any employee who is authorized to direct traffic or enforce parking laws of a city, county, or jurisdiction of a State agency in which a vehicle is located, may remove a vehicle located within their territorial limits.

Vehicles may be removed when left standing upon a highway in a position so as to create a hazard or obstruct the normal movement of traffic. When signs are posted on a highway to warn that vehicles will be removed after 24 hours, vehicles parked over 24 hours will be removed at the owner's expense.

Any vehicle, except emergency vehicles or vehicles authorized by Caltrans, left standing for more than 8 hours within a roadside rest area or viewpoint can be removed.

#### **Accident Reports Required**

See Chapter 1, Section 1.12, of Maintenance Manual, Volume One.

#### **Animal Carcasses: PC 374d**

It is a misdemeanor for anyone to put an animal carcass within 100 feet of any street, alley, public road, or road in common use. Any animal owner who knowingly allows another person to place a carcass on or near a road is also guilty of this misdemeanor.

#### **Chains (Tire) Required: S&HC 124 , S&HC 670 , VC 27459-27460**

The authority of Caltrans to restrict usage of highways or close highways includes the authority to require tire chains due to snow conditions when chains are required for the safety of the public.

#### **Civil Liability and Financial Responsibility of owners and operators of Motor Vehicles: 17001 VC**

The State is liable for death or injury to persons or property proximately caused by the negligent operation of any vehicle by a State employee acting within the scope of his or her employment.

**Clean Water Act: 33 USC 1342**

The Federal Clean Water Act (CWA) provides national standards for water pollution control and water quality management. The 1987 amendment to the CWA established a framework for regulation of storm water discharge, including minimum standards for industry, water quality standards, and a discharge permit program.

See this section, National Pollution Discharge Elimination System - 40 CFR 122.26.

Refer to Chapter F of this manual for detailed information regarding the Maintenance Water Quality Program.

**Closing Highways: VC 2812**

The Highway Patrol, Police, and Sheriffs have authority to close a State highway whenever poisonous gas, explosives, dust, smoke, other similar substances, or fire exist upon or so near a public highway as to create a menace to public health or safety.

**Closing Highways, Notice of: S&HC 125 , S&HC 127**

Section 125 provides that the Department may notify the public of highway closures or restricted use, and may take the following actions:

- (A) Erect suitable barriers or obstructions upon the highway.
- (B) Post warnings and notice of the condition of the highway.
- (C) Post signs for the direction of traffic, or over any detour open to public travel.
- (D) Place warning devices on the highway.
- (E) Assign a flagger to warn, detour, or direct traffic on the highway.

Section 127 instructs the California Highway Patrol to cooperate in the enforcement of the closing or restricted use of the highways.

**Closing State Highways: S&HC 124**

This section gives Caltrans the authority to restrict the use of, or close, any State highway whenever closing or restriction of use is considered necessary for:

- (A) Protection of the public.
- (B) Protection of highways from damage during storms, during construction improvement, or maintenance operations on the highways.

This section also permits the temporary closing of a State highway for salvage operations by tow trucks for the purpose of salvaging wrecked vehicles. All salvage operations which cannot be completed within thirty minutes, and in which the blocking or partial blocking of the highway is necessary, shall be prohibited until the operator of the salvage equipment secures an encroachment permit. The above instructions do not apply where the life or safety of occupants of the vehicle are at issue, or where wrecked vehicles are blocking the highways.

**Closing Street or Highway: VC 21102**

Local authorities may, by ordinance or resolution, close State highways dividing a school ground when, in the opinion of the legislative body having jurisdiction, the closure is necessary for the protection of school children. The closing to vehicular traffic may be limited to such hours and days as the legislative body may specify. The closure must be approved by Caltrans.

**Contracting, Constraints and Requirements: PCC 10108**

Where the nature of the work to be performed is such that Caltrans services are not required, Maintenance may authorize that the project be carried out directly by the appropriate State agency. If this is done, the estimated cost shall not exceed \$250,000.

If the estimated total cost of any construction project or work carried out under this section exceeds \$25,000, Caltrans shall solicit bids in writing and shall award the work to the lowest responsible bidder or reject all bids.

The director may authorize Caltrans to carry out work in excess of \$25,000 under the provisions of this section by Day Labor if he or she deems that the award of a contract or the acceptance of bids is not in the best interests of the State. In no event shall the amount of work performed by Day Labor under this section exceed the sum of \$35,000.

**Contracts, Day Labor: PCC 10122**

Work on all projects will be performed under contract with the lowest bidder. Under the following circumstances, work may also be done by Day Labor under direction of the Department, by contract upon informal bids, or in combination:

- (A) In case of emergency due to the failure or threat of failure of a bridge or other highway structure.
- (B) In case of emergency due to the failure or threat of failure of any dam, reservoir, aqueduct, or other water facility.
- (C) In case of emergency due to damage to a state owned building or any other state property or improvements. An emergency includes, but is not limited to, damage by storm, flood, fire or earthquake.
- (D) At any time after the approval of plans, specifications, and estimates of cost, if the director deems the advertising or award of a contract, or acceptance of bids, is not in the best interests of the State.

**Contracts, Day Labor Limit: PCC 10122.6**

Regardless of the project cost limit provided in previous sections, work in excess of \$25,000, which would otherwise constitute a project, shall not be done by day labor unless the requirements of Section 10122 are met.

**Curb Markings to Indicate Parking Regulations: VC 21458(a)**

Whenever local authorities enact local parking regulations and indicate them by the use of paint upon curbs, the following colors only shall be used, and the colors indicate as follows:

- (1) Red indicates no stopping or parking, except that a bus may stop in a red zone marked or sign posted as a bus-loading zone.
- (2) Yellow indicates stopping only for the purpose of loading or unloading passengers or freight for the time as may be specified by local ordinance.
- (3) White indicates stopping for either loading or unloading passengers or depositing mail in an adjacent mailbox.
- (4) Green indicates time limit parking specified by local ordinance.
- (5) Blue indicates parking limited exclusively to the vehicles of persons with disabilities.

**Damage to Highways or Bridges: S&HC 730**

This section provides that any person who willfully or negligently injures or damages any state highway is liable for the cost of its repair. Furthermore, the willful injuring of any bridge, culvert, or structure in or on any State highway is a misdemeanor.

**PC 588**

This section provides that every person who negligently, willfully or maliciously takes any of the following actions is guilty of a misdemeanor:

- (A) Digs up, removes, displaces, breaks down, or otherwise injures or destroys any State or public highway, bridge or any private way laid out by authority of law; or
- (B) Drains, diverts, or in any manner permits by seepage, overflow or otherwise, any waters from lands adjacent to or in the vicinity of any State highway or bridge.

**Damage to Highway or Bridge, Liability for: VC 17301-17303**

- (A) Any person driving or moving any vehicle or object over a highway or bridge shall be liable for all damages the highway or bridge may sustain as a result of any illegal operation, driving or moving of the vehicle or object. The person shall also be liable for damages caused by driving or moving a vehicle or object weighing in excess of the maximum weight specified in the Vehicle Code, even if authorized to do so by a special permit issued by Caltrans.
- (B) Whenever the driver is not the owner of the vehicle or object but is operating, driving, or moving it with the owner, the owner and driver shall be jointly and severally liable for any damage.
- (C) The driver and/or owner shall also be liable for all damages which any highway or bridge may sustain as the result of any operation, driving, or moving of any vehicle which exceeds any of the limitations imposed by Division 15, Chapter 1 of Division 13, and Section 21461, with respect to signs erected under Section 35655 and Sections 21712 and 23114 of the Vehicle Code.
- (D) The damage may be recovered in a civil action brought by the authorities in control of the highway or bridge.

Damage to highways, guardrail, and structures, shall be reported by Maintenance personnel in the Integrated Maintenance Management System (IMMS), on an Accident Log. The form is to show full information, including name and address of parties responsible for the damage, and an estimate of the restoration cost.

See the Caltrans Accounting Manual and Chapter 1, Section 1.12.3 of this manual for additional information regarding damage reporting process.

**Damage to Highway by Water: PC 588, S&HC 725**

See above: Damage to Highway or Bridges, Liability for.

**Damage to Signs, Barricades, and Lights: PC 588b , VC 21464**

Official traffic control devices, traffic guideposts, traffic signposts, motorist call boxes, and historical markers are protected by law. Any person who defaces, injures, attaches any material or substance to, knocks down, removes, or shoots at them is guilty of a misdemeanor.

**Damage to Trees, Shrubs, Etc.: PC 384a**

The damage, destruction, or removal of native trees and shrubs growing upon State or County highway rights of way, except by employees of the State or political subdivision, is a misdemeanor.

**S&HC 730.5**

Any person, who by any means willfully or maliciously digs up, cuts down, destroys or otherwise injures any shade or ornamental tree on any State right of way shall be liable to a penalty in the sum of \$ 10,000 for each tree so damaged, and \$1,000 for each shrub damaged.

**Detours: VC 21363**

This section provides that Caltrans may construct and maintain detours where State highways are closed or obstructed by construction or otherwise. Caltrans may also use any other public highway as a detour.

Upon completion of the use and upon request of the local agency having jurisdiction over the highway, Caltrans must restore it to its former condition. However, the local agency must reimburse Caltrans for any improvements resulting from restoration. Caltrans must reimburse the local agency for any additional expenses incurred by that agency in maintaining the highway during the period of detour.

**Drainage or Impounding of Water: S&HC 725-729**

See Water, below.

**Dumping on Highway: PC 374b, VC 23112**

This section prohibits the dumping of any waste upon any public highway, including any portion of the right of way. Any person, firm, or corporation violating these provisions shall be guilty of a misdemeanor.

**Equipment, Highway: VC 25256, VC 25800-25802**

Highway equipment is exempt from restrictions on lights mounted on vehicles. Caltrans Maintenance vehicles may display flashing amber lights on front, sides, or rear when parked or working on the highway.

**Equipment, Snow Removal: VC 35001**

Snow removal equipment is exempt from vehicle dimensional limitations found in the Vehicle Code.

**Encroachment Permits: S&HC 670**

This section requires that permits be obtained for any encroachment on the State highway (all or any part of entire right of way), such as any tower, pole, pole line, pipe, pipeline, fence, stand or building or any structure of any kind placed under or over the State highway.

**Encroachments, Removal of: S&HC 720-724**

These sections outline the manner and procedure for the removal of encroachments that are a nuisance and objectionable.

Unless the encroachment is authorized under Sections 670 to 673, anyone controlling or allowing an encroachment to exist within any State highway, after having been served with a notice for its removal, shall be guilty of a misdemeanor.

Saw logs, which have been spilled from loads by unknown parties and abandoned within the State highway right of way, constitute an encroachment. Notice demanding removal shall be given by posting on the logs for a period of five (5) days. Thereafter, the logs may be removed with State forces.

**Explosives, Transportation of: VC 27903**

Any person who operates a motor vehicle transporting an explosive substance shall display on each side and the rear of the vehicle a sign with the word “explosives” in letters not less than three (3) inches in height upon a background of sharply contrasting color.

Tank trucks are excepted when the trademark or trade name descriptive of the cargo is displayed. See Chapter 7, Section 7.21: Explosives.

**Ferry Connections: S&HC 100.5**

This section authorizes the Department to own, maintain or arrange for joint construction of ferries within the State, and to provide load limits and hours of operation, as well as collect for any damage by traffic.

**Fire Fighting: PRC 4153**

The California State Department of Forestry’s agent may summon any able bodied person to assist in forest fire fighting, except farmers harvesting perishable agricultural crops, or members of fire departments already subject to call for fire fighting duty.

See Chapter 1 of this manual, Appendix 1-B: Cooperative Agreement with California Department of Forestry - Fire Suppression.

**Flags: GC 431**

The Flag of the United States and the Flag of the State shall be prominently displayed during business hours upon or in front of the buildings or grounds of or at each of the following places:

- (A) Each public building belonging to the State, a county, or a municipality.
- (B) At the entrance and exit of every State park.
- (C) At the entrance or upon the grounds of each campus of the University of California.
- (D) At the entrance or upon the grounds or upon the administration building of every university, college, high school, and elementary school, both public and private, within the State.
- (E) Upon or at every agricultural inspection station just inside California and located on every highway leading into California.

- (F) At the entrance of or within every State highway Maintenance station where personnel reside or are on duty at the time necessary to raise and lower the Flag.

**Franchise in State Highways: S&HC 680-695**

Whenever a franchise is granted by any county or city in any public highway, which has been or is subsequently constituted a State highway, the Department may enforce any obligations of the grantee or holder of the franchise with respect to the repair of the highway.

**Freeway: S&HC 23.5**

The term “freeway” shall be deemed to mean a highway in respect to which the owners of abutting lands have no right or easement of access to or from their abutting lands or in respect to which owners have only limited or restricted right or easement of access.

**Litter: VC 23112**

No person shall throw upon any highway any bottle, can, garbage, glass, nail, offal, paper, wire, any substance likely to injure or damage traffic using the highway, or any noisome, nauseous, or offensive matter of any kind. No person shall aid or abet in the throwing of these materials.

Without consent from Caltrans, no person shall place, deposit, or dump, or cause to be placed, deposited, or dumped, any rocks, refuse, garbage, or dirt in or upon any highway. This includes any portion of the right of way connected to the highway.

**Glass, Nails, Etc., Placing on Highway: VC 23113**

**VC 23113**

- (a) Any person who drops, dumps, deposits, places or throws, or causes or permits to be dropped, dumped, deposited, placed or thrown, upon any highway or street any material described in Section 23112 or 23114(d) (aggregate materials) shall immediately remove the material or cause the material to be removed.
- (b) If a person, who drops, dumps, deposits, places or throws materials described in Section 23112 or 23114(d) and does not remove it, Caltrans may remove the material. If necessary, Caltrans may bring a civil action to collect the actual cost of the removal operation in addition to any other damages authorized by law from the responsible party.

See also Penal Code, Sections 374(b) and 588(a).

### **Historical Landmarks: S&HC 101**

This section instructs Caltrans to keep in repair all objects or markers adjacent to a State highway that have been erected to mark registered historical places.

Caltrans is also required to keep the markers free from vegetation that may obscure them from view. These instructions include entering private property to repair historical landmark markers or monuments adjacent to the State highway.

### **Injured Persons: VC 20016**

Employees assigned to Maintenance may transport or arrange for the transportation of a person injured in an accident upon any highway. If the injured person does not object, he or she may be transported to a physician or to hospital.

An employee who exercises ordinary care and precaution shall not be liable for any damages due to any further injury or for any medical, ambulance or hospital bills incurred in behalf of the injured party.

### **Landscaped Freeway: B&PC 5216**

The term "landscaped freeway" refers to a section or sections of a freeway that is now, or may later be, improved by the planting of at least on one side of the freeway right of way of lawns, trees, shrubs, flowers, or other ornamental vegetation that shall require reasonable maintenance.

Planting for the purpose of soil erosion control, traffic safety requirements, reduction of fire hazards, or traffic noise abatement, shall not change the character of a freeway to a landscaped freeway.

### **Leasing of Equipment: S&HC 136, 136.5**

The Department may enter into contracts for the leasing or renting of tools or equipment for State highway purposes. The contracts referred to in these sections are not subject to the provisions of the State Contract Act.

When the total consideration of such a contract exceeds \$2,500, it shall be awarded to the lowest responsible bidder, after competitive bidding on reasonable notice as the Department may prescribe. Posting of a notice for five (5) days in a public place in a Caltrans District Office in which the work is to be done, or the equipment used, is sufficient notice.

Such contracts involving a consideration of less than \$25,000 need not be accompanied by labor and material bonds. Caltrans may require faithful performance bonds when considered necessary. The advertisement for each contract shall state whether or not a bond shall be required. Where a faithful performance bond is required, labor and material bonds shall also be required.

In cases of emergency work necessitated by the imminence or occurrence of a land slide, flood, storm damage, accident, or other casualty, tools or equipment may be rented for a period of not to exceed 20 days without competitive bidding.

See Chapter 2 of this manual: Resource Management.

**Length of Vehicles, Maximum Permitted: VC 35400-35414**

This code section specifies that no vehicle shall exceed a length of 40 feet, but provides a list of exceptions. The exceptions include vehicles in combination, excess length resulting from safety devices, and semi-trailers pulled by motor-truck tractors.

**Liability of Public Employees: GC 840.2**

Employees of the State are personally liable for their own actions, and for damage claims or losses which occur as a result of carelessness. However, no employee shall be liable for any damage or injury to persons or property resulting from the condition of any street, highway, bridge, building, work or property, unless:

- (A) The public property was in a dangerous condition at the time of injury;
- (B) The injury was proximately caused by the dangerous condition;
- (C) The dangerous condition created a reasonably foreseeable risk of the kind of injury that was incurred; and
- (D) Either
  - (1) The State employee created the dangerous condition, or
  - (2) The State employee had actual or constructive notice of the dangerous condition and the authority and funds available to protect against the dangerous condition.

## **License Requirements**

### **12500 – VC 12527**

Section 12500 provides the requirements for vehicle operator's licenses, for both Class C (driver's license) and Classes A and B (commercial driver's licenses).

### **VC 32000 - 32005**

This section of the Vehicle Code provides licensing requirements for the transportation of hazardous materials. It also provides placarding requirements for specific types of hazardous materials.

## **Livestock on Highways: F&AC 16902**

A person that owns or controls the possession of any livestock shall not willfully or negligently permit any of the livestock to stray upon a public highway, if both sides of the highway are adjoined by property that is separated from the highway by a fence, wall, hedge, sidewalk, curb, lawn, or building. No person shall permit livestock to remain unaccompanied by a person in charge or control of the livestock upon a public highway.

## **Load Limits**

### **VC 35750-35755**

This section provides that Caltrans may determine the standards for weight limits on bridges and place signs to advise the public. The code prohibits any person from driving an overweight vehicle over a bridge. Violations are punishable by fines set out in the code.

### **VC 35550-35601**

This section sets out weight limits for vehicles that are driven on the highways. The code section specifies load limits on wheels and tires, and includes a matrix that provides the weight permitted per each axle.

### **VC 35780-35785**

This section provides that Caltrans or local authorities may issue special permits that allow vehicles to operate in a manner that is not in compliance with Vehicle Code sections. The section sets out the requirements for such permits.

## **Lost and Found Property: 2080 CC**

### **Duty to Inform the Owner of Lost Property: CC 2080**

This Code section provides that a person who finds property shall inform the owner within a reasonable time and return the property to the owner.

### **Disposition of Found Property: CC 2080.1**

This Section provides direction regarding property with a value of more than \$100 when the owner of property is unknown. The property shall be turned over to the city police department if found within the city limits, or to the sheriff's department if found outside the city limits.

### **State Employees may not Keep Found Property: CC 2080.3**

Section 2080.3 provides that if the unknown owner of property cannot be located, the person who finds the property takes title “unless the property was found in the course of employment by an employee of any public agency, in which case the property shall be sold at public auction”.

Chapter 1 of this manual, Section 1.07: Use and Disposal of State Property, and Lost and Found Items, provides detailed instructions regarding lost and found items.

## **Maintenance, Definition of General Provisions: S&HC 27**

Under this code, “maintenance” includes any of the following:

- (A) The preservation and keeping of right of ways, and each type of roadway, structure, safety convenience or device, planting, illumination equipment, and other facility, in the safe and usable condition to which it has been improved or constructed, but does not include reconstruction or other improvement.
- (B) Operation of special safety conveniences, devices, and illumination equipment.
- (C) The special or emergency maintenance or repair necessitated by accidents or by storms or other weather conditions, slides, settlements, or other unusual or unexpected damage to a roadway, structure, or facility.

The degree and type of maintenance for each highway, or portion of highway, shall be determined in the discretion of the authorities charged with the highway's maintenance. The authority shall take into consideration traffic requirements and moneys available.

**No Passing Zones: VC 21459-21460**

This Vehicle Code section authorizes Caltrans to place and maintain distinctive roadway markings in no passing zones. The section specifies the types of markings that are required.

**National Pollution Discharge Elimination System: 40 CFR 122.26**

In 1990, the National Pollution Discharge Elimination System (NPDES) was established in Title 40 of the Code of Federal Regulations, Part 122, Section 26. This regulation requires permits for discharge into the storm water system by industry, large municipalities, and construction sites. NPDES applies to storm water discharged from interstates and the State highway system.

The NPDES program also requires a Storm Water Pollution Prevention Plan (SWPPP) for facilities, and development of Best Management Practices (BMPs) designed to prevent pollution of storm water.

See Chapter F of this manual, Maintenance Water Quality Program for detailed information.

**Parking Regulations: VC 22505-22520, VC 41102**

Caltrans may place signs or markings that prohibit stopping, standing, or parking of vehicles that are 6 feet or more in height, including load. Where necessary, Caltrans has the authority to prohibit stopping or parking of smaller vehicles.

**Permits to Governmental Units: S&HC 810**

This section allows governmental units (such as Caltrans) to do paving, curb and gutter, sewer work, fixing of grades, and other improvements and repairs, when a permit is obtained for work.

**Personal Services Contracts: GC19130**

This code outlines the constraints for using Personal Services contracts. Under this code, Personal Services contracts can only be applied when the contracted activity will exhibit cost savings or if the activity is exempted from civil service by the California Constitution. Several of the most significant exempted activities include:

- (A) Contracts for new State functions, and the legislature has specifically authorized the performance of work by independent contractors.
- (B) Services not available within the civil service.

- (C) Activities where the contractor will provide equipment, materials, facilities, or support services that could not be provided by the State in a specific location.
- (D) Services that are of an urgent, temporary, or occasional nature.

For more information, see Chapter 2 of this manual: Resource Management, and Chapter 1 of this manual, Section 1.11.4: Service Contracts.

### **Pests on Highway: F&AC 5492**

When a pest is found on the highway, right of way, or other property that is subject to Caltrans control, the County Agricultural Commissioner will notify the Department of Food and Agriculture (DF&A). The Director of DF&A will either notify Caltrans directly, or may direct the Agricultural Commissioner to serve notice to Caltrans that there is a pest. If the County Agricultural Commissioner performs eradication, control, or destruction of the pest, the cost shall be paid by Caltrans.

This section applies to a State highway right of way if any pest of the same kind has been found and controlled on other private or public property in the immediate vicinity, either at the direction of the Commissioner or voluntarily by the owner of adjacent property.

Any employee who is advised of a pest on the right of way shall immediately report this to his or her supervisor.

See Chapter C2: Vegetation Control for detailed information regarding regulation of pesticides and legal requirements for worker safety.

### **Poles within Freeways: S&HC 700-711**

If Caltrans requires the removal of any utility facility lawfully maintained in the freeway right of way to a location entirely outside the right of way, the Department shall pay the reasonable and necessary cost of removal and relocation.

This section does not apply to the relocation of the utility facility from one point in a freeway to another point in the freeway.

### **Poles, Telephone and Telegraph: PUC 7901**

Telephone and telegraph poles may be placed in State highway rights of way.

The telegraph or telephone lines must be constructed in such a manner and installed in locations that they will not interfere with public use of the road or highway, or interrupt navigation of nearby waters.

Encroachment permits must be obtained before any telegraph or telephone lines are constructed or repaired within a highway right of way.

**Project: PCC 10105**

A “project” includes the erection, construction, alteration, repair, or improvement of any State structure, building, road, or other State improvement of any kind that will exceed a total cost calculated pursuant to this section.

The total cost limitations for projects are set out in this section. Every two (2) years, the total cost limit is adjusted upward or downward by the Director of Finance to reflect the percentage change in the annual California Construction Index as used by the Department of General Services. The amount is rounded off to the nearest 1,000-dollar figure.

See Chapter 2, Section 2.04 of this manual: Limitations and Use of Funds.

**Protection of Public Utilities: GC 4216-4217**

Maintenance personnel shall contact a Regional Notification Center to locate underground utilities prior to excavating.

See Chapter 1, Appendix 1-C: Instructions for Use of Underground Service Alert (USA).

**Public Officers and Employees Must Obey Vehicle Code: VC 21052**

Public employees are not exempt from the provisions of the Vehicle Code.

**Removal or Breaking Barriers, Signs, and Lights: PC 588b, PC 590, VC 21464**

Anyone who commits the following acts is guilty of a misdemeanor:

- (A) Willfully breaks down, removes, injures, or destroys any barrier or obstruction erected or placed in or upon any road or highway by Caltrans or its contractors.
- (B) Willfully tears down, defaces, removes, or destroys any warnings, notices, or directional signs erected, placed or posted, in, upon, or adjacent to any road or highway.
- (C) Willfully extinguishes, removes, injures, or destroys any warning light or lantern, or reflectorized warning or directional sign, erected, placed or maintained by any authority in, upon or adjacent to any road or highway, shall be guilty of a misdemeanor.

- (D) Maliciously removes, destroys, injures, breaks or defaces any milepost, board or stone, or guidepost erected on or near any highway, or any inscription on a highway.

**Rubbish Vehicles - Cover for Load: VC 23114, 23115**

Maintenance trucks that may be hauling papers, cartons, and other roadside litter are required to have a cover sufficient to prevent the load from spilling upon the highway. This section does not prohibit a rubbish vehicle from being without a cover while in the process of acquiring its load.

Vehicles transporting aggregate materials shall not be required to cover their loads if the load, where it contacts the sides of the cargo container, remains 6 inches below the upper edge and the peak of the load does not extend above the upper edge.

**Safety Orders: LC 3300**

Section 3300 of the Labor Code designates the State of California and every State agency as an “employer”. State agencies are, therefore, required to comply with Safety Orders and Regulations issued by the Division of Industrial Safety.

Safety Orders are issued from time to time and old orders are amended.

The Office of Employee Safety will provide a copy of specific sections as requested, and will advise where the Safety Orders may be purchased.

It shall be the duty of all Maintenance Supervisors to familiarize themselves with the various Safety Orders that apply to their particular type of work.

**Safety Devices and Safeguards: LC 6400-6407**

The Labor Code requires Caltrans, as an employer, to furnish employment and a place of employment that are safe and healthful for its employees. Caltrans must furnish safety devices and safeguards, and adopt and use safe practices and methods that are reasonably adequate for the safety of employees.

No employer shall require or permit any employee to go, or be in, any place of employment that is not safe. Employers shall do everything reasonably necessary to protect the life, and safety and health of employees.

**School - Markings and Crosswalks: VC 21368**

A marked pedestrian crosswalk in a roadway near a school building or school grounds shall be painted or marked in yellow. All marked pedestrian crosswalks at intersections shall be marked in yellow if yellow marking is required on one of the crosswalks.

Other established marked pedestrian crosswalks may be painted or marked in yellow if either:

- (A) The nearest point of the crosswalk is not more than 600 feet from a school building or school grounds or:
- (B) All of the following conditions are met:
  - (1) The nearest point of the crosswalk is not more than 2,800 feet from a school building or school grounds;
  - (2) There are no intervening crosswalks other than those next to the school grounds; and;
  - (3) It appears that the facts and circumstances require special painting or marking of the crosswalks for the protection and safety of persons attending the school.

The following words shall be painted or marked in yellow on each side of the street, in the lane or lanes leading to all yellow marked crosswalks: "SLOW--SCHOOL XING". The words shall not be painted or marked in any lane leading to a crosswalk at an intersection controlled by stop signs, traffic signals, or yield right of way signs.

A crosswalk shall not be painted or marked yellow at any location other than as required or permitted in this section.

**Selling on Right of Way Prohibited: S&HC 731**

It is a misdemeanor to park a vehicle or structure on the right of way for the purposes of selling the vehicle or structure, or to sell items carried within a vehicle or structure.

Vehicles or structures placed on the right of way for the purpose of selling them are a public nuisance. Caltrans shall remove them from the highway.

Vendors may take orders and deliver items from a vehicle on the State highway immediately adjacent to the premises of the purchaser.

**Standardized Emergency Management System (SEMS): GC Section 8607**

As a Department of State government, Caltrans is required is by Section 8607 of the California Government Code to use the Standardized Emergency Management System (SEMS) in any multi-agency emergency response.

All Caltrans Maintenance field personnel and district Maintenance management shall attend SEMS training.

See Chapter D5 for detailed information regarding SEMS training requirements.

**SIGNS**

**California Missions: S&HC 123.5**

The Department is required to erect and maintain signs directing the way to each of the 21 California Missions originally established by the Franciscan Fathers, at the State highway intersection or off ramps nearest to each of the Missions.

For further instructions regarding signs and monuments for registered historical landmarks, see the Traffic Manual.

**Detour: VC 21363**

Detour signs shall be placed at the nearest points of detour from the portion of the highway, or from any bridge, which is closed to traffic while under construction or repair.

**Livestock Crossings: VC 21364**

Caltrans may authorize the owner of land adjacent to the highway to place and maintain signs to indicate the existence of places where livestock frequently cross the highway. Any livestock crossing sign must be maintained as an official sign. Caltrans shall specify the size, shape and character of the signs.

**Official Signs and Traffic Control Devices: VC 21350, 21400**

Section 21350 gives Caltrans the authority to erect and maintain appropriate signs, signals, and other traffic control devices to carry out the provisions of the Vehicle Code.

Section 21400 requires Caltrans to adopt rules and regulations that establish uniform standards and specifications for official traffic control devices.

**Open Range: VC 21365**

This section authorizes Caltrans to place and maintain signs indicating that territory is open range, to warn against the danger of livestock on the highway.

**Railroad Warning Signs: VC 21362**

Section 21362 requires the local authority with jurisdiction to erect railroad-warning signs on the right side of each approach to railroad or light rail grade crossings. As the authority with jurisdiction over State highways, Caltrans is responsible for placing and maintaining these signs.

**Speed Limit Signs, Location of: VC 21357-21359**

These sections provide instructions for placement of speed restriction signs.

**Speed Limit Signs, Specifications for: VC 21400**

All speed limit signs shall be uniform. Caltrans, after notice and public hearings, determines the specifications for all signs placed on the highway.

**Stop Signs, Authority for: VC 21352, VC 21353**

Caltrans may erect stop signs at any entrance to a State highway whenever it determines that it is necessary for public safety and orderly and efficient use of the highways.

**Stop Signs, Specification for: VC 21400, VC 21401**

All stop signs shall be uniform. Caltrans determines the specifications for all stop signs.

**Street Name Signs: VC 21400**

Caltrans shall adopt rules and regulations that establish uniform standards and specifications for street name signs.

**Street Name Signs Required at Controlled Intersections: VC 21366**

A street name sign, clearly visible to the principal flow of traffic, is required at each intersection on streets and highways that is controlled by a signal.

**Yield Sign, Authority for use: VC 21356**

Caltrans may erect yield signs at the entrances of intersections or highways under its jurisdiction. The signs shall be located at or near the entrance of the intersection or highways where motorists are required to yield the right of way. Yield signs shall not be erected upon the approaches to more than one of the intersecting streets.

**Speed Limit Zones: VC 22351, VC 22352**

Caltrans has the authority to erect signs on State highways necessary to carry out the provisions of the Vehicle Code. The Department may also erect speed limit signs that are necessary for public safety or for the orderly and efficient use of highways by the public.

**Establishment of Speed Limits: VC 22348-22364, VC 22400-22407**

Sections 22348-22364 provides that no person shall exceed established speed limits. The maximum speed limits are set forth. These sections also provide punishments for infractions of the law.

**School: VC 22352**

This section establishes a speed limit of 25 miles per hour when passing a school building or school grounds while children are going to or leaving school, or during noon recess.

Section 22350 provides the basic speed law:

“No person shall drive a vehicle upon a highway at a speed greater than is reasonable or prudent having due regard for weather, visibility, the traffic on, and the surface and width of, the highway, and in no event at a speed which endangers the safety of persons or property.”

Section 22354 authorizes Caltrans, upon the basis of an engineering and traffic survey, to establish speeds lower than 65 miles per hour when it is appropriate for public safety or to facilitate the orderly movement of traffic.

Section 22400 prohibits any person from driving on a highway at such a slow speed as to impede traffic or block the normal and reasonable movement of traffic, unless the slow speed is necessary for safe operation or because of a grade.

Caltrans may establish minimum speed limits on the basis of engineering and traffic surveys. Section 22402 authorizes Caltrans, after an engineering investigation, notice and a public hearing, to determine maximum speeds that can be maintained with safety on any bridge, elevated structure, tube or tunnel on a State highway.

Section 22406 establishes a speed limit of 55 miles per hour for the following vehicles:

- (A) A motor-truck or truck tractor pulling another vehicle.
- (B) A passenger vehicle or bus towing another vehicle.
- (C) A school bus transporting students.
- (D) A farm labor vehicle transporting workers.
- (E) A vehicle transporting explosives.
- (F) A trailer bus.

Section 22406.5 prohibits driving tank vehicles that carry more than 500 gallons of flammable liquid from traveling over applicable speed limits.

**Bridges: VC 22402-22405**

Caltrans is authorized to establish maximum speed limits on bridges after conducting an engineering investigation, providing notice and a public hearing.

**Business District: VC 235, VC 515, VC 240**

Section 235 defines a “business district” as a portion of a highway on which is:

- (A) At least 50 percent of the buildings facing one side of the highway for a distance of 600 feet are businesses or;
- (B) At least 50 percent of the buildings on facing both sides of the highway for a distance of 300 feet are businesses.

Section 515 provides that a “residence district” is one where, within a distance of a quarter of a mile, the highway is fronted by 13 or more dwelling houses or business structures on one side of the highway.

Section 240 provides detailed instructions for determining if a highway is within a business or residence district.

**Residence District: VC 21357**

This section provides that speed restriction signs may be erected on any highway other than a State highway at the entrance of a business or residence district.

See Business District, above.

**Truck (Descending Grades): VC 22407**

Section 22407 authorizes Caltrans to establish reduced speed limits for vehicles over 10,000 pounds gross weight when traveling down grades.

**Spilling Loads on Highway Prohibited: VC 23114**

This section prohibits spilling loads onto the highway other than clear water or feathers from live birds. It provides detailed requirements for vehicles that carry cargo.

**State Parks, Highways in: S&HC 122-123**

These sections provide for road maintenance or construction in State parks, subject to the approval of the park authority. The above provisions neither affect nor limit Caltrans authority, possession or control of any State highway, even though any portion of the highway is located within a State park.

**Stock Trails: S&HC 105**

This section authorizes Caltrans to construct and maintain "stock trails" approximately paralleling any State highway. Caltrans may retain and maintain these stock trails if the right of way of any State highway is superseded by relocation. Caltrans is required to post signs or notices at the entrances of stock trails, directing all persons to drive untethered stock on the trail. Persons driving untethered livestock on a State highway that parallels a stock trail are guilty of a misdemeanor. In addition, they are liable for all damage done to the highway.

**Survey Monuments, Perpetuation of: B&PC 8771**

This section requires perpetuation of survey monuments likely to be destroyed by construction or reconstruction of highways and roads.

Pre-inspection of maintenance sites should include a search for known or suspected survey monuments. Existing survey monuments must not be disturbed, overlaid, destroyed, or obliterated.

The supervisor shall notify the District Surveys Engineer if survey monuments will be affected by maintenance operations, or if the supervisor cannot determine the impact of maintenance operations on survey monuments.

With sufficient advance notice, the District Surveys Engineer can perpetuate survey monuments, as necessary, in conformance with Section 8771.

**Traffic: VC 620**

Traffic includes pedestrians, ridden animals, vehicles, streetcars and other conveyances, either singly or together, while using any highway for purposes of travel.

**Traffic Direction: VC 2410**

In the event of any emergency, to expedite traffic, or to insure safety, the Highway Patrol is authorized to direct traffic, as conditions require without regard to provisions of the Vehicle Code.

**Unauthorized Signs, Signals, and Lights, Display of Prohibited: VC 21465-21467**

The Vehicle Code prohibits the display of the following within view of the highway:

- (A) Any unofficial sign, signal, device, or marking, or any sign, signal, device, or marking which is an imitation of an official traffic control device.
- (B) Any unofficial sign, signal, device, or marking which attempts to direct the movement of traffic.
- (C) Any unofficial sign, signal, device, or marking which hides from view any official traffic control device.
- (D) Any light of any color of such brilliance, that it impairs the vision of drivers upon the highway.

The Department of Transportation, the California Highway Patrol, and local authorities are authorized to remove any unofficial sign, signal, device, or marking. The Director of Transportation, the commissioner, or local authorities may bring an action as provided by law to abate this nuisance.

**Warning Signs, Lights, and Devices for Highway Work: VC 21400**

Caltrans shall, after consultation with local agencies and public hearings, adopt rules and regulations prescribing uniform standards and specifications for all official traffic control devices placed pursuant to this code.

This includes, but is not limited to, stop signs, yield right of way signs, speed restriction signs, railroad warning approach signs, street name signs, lines and markings on the roadway, and stock crossing signs placed pursuant to Section 21364.

**Water: S&HC 725-727**

It is unlawful for any person to permit water to be turned from his land to any State highway which results in damage to the highway.

It is unlawful to do the following:

- (A) Drain water, or permit water to be drained from his lands onto any State highway by any means that results in damage to the highway.
- (B) Obstruct any natural watercourse so as to:
  - (1) Prevent, impede or restrict the natural flow of waters from any State highway into and through the watercourse, unless other adequate and proper drainage is provided.
  - (2) Cause waters to be impounded within any State highway, damaging the highway.
  - (3) Cause interference with, or damage or hazard to public travel.
- (C) Store or distribute water for any purpose so as to permit it to overflow onto, to saturate by seepage, or to obstruct any State highway, with resulting damage to the highway.

Section 720 requires that Caltrans provide a written notice of encroachment. If the encroachment is not corrected and repairs made at the violator's expense after written notice, Caltrans may make corrections and repairs and recover by law the cost of repairs. Section 720 also permits Caltrans to collect the sum of \$10 for each day the drainage; diversion, overflow or seepage is permitted to continue after service of notice, together with the costs and expense incurred with such action.

See Chapter F of this Manual: Maintenance Storm Water Pollution Prevention Program.

**Weighing: VC 2802-2803 VC**

Officers of the California Highway Patrol may weigh vehicles and require the removal of excess load.

**Weight Limits**

See Load Limits, above.

**Width of Vehicles, Maximum permitted: VC 35100-35111**

The total outside width of any vehicle or its load shall not exceed 102 inches.

Safety devices that the Secretary of Transportation determines to be necessary for the safe and efficient operation of motor vehicles shall not be included in the calculation of width.

Any city or county may, by ordinance, prohibit a combination of vehicles of a total width in excess of 96 inches upon highways under its jurisdiction. The ordinance shall not be effective until appropriate signs are erected indicating the streets affected.

# **CHAPTER 4**

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*Original signed by*

Nate Cradle

Office of Maintenance Equipment and Training

Division of Maintenance

#### **4.00 Introduction**

The Division of Maintenance, Office of Maintenance Equipment is responsible for monitoring District Maintenance compliance with all requirements in this chapter.

The Division of Equipment (DOE) is delegated the authority by the Department of General Services (DGS) to oversee all Mobile Fleet, component, and non Mobile Fleet accessories purchases. Items affected are listed in the Division of Procurement and Contracts (DPAC) Acquisition Manual.

All mobile pieces of automotive, maintenance, and construction equipment are purchased and maintained by the Division of Equipment and assigned to districts or the Headquarters Maintenance pool. This equipment is designated as Mobile Fleet equipment and normally is assigned a seven (7) digit identification number (ID). Equipment types are identified by a five (5) digit Maintenance Class (MC). This five-digit number is used to identify the type and size of each piece of equipment in the fleet.

Streets and Highways Code Section 140.3 “A” contains the legislated definition of the Department’s Mobile Fleet. The definition is as follows: “Mobile Equipment” means devices owned by the Department by which any person or property may be propelled, moved, or drawn on or off highway and that are used for employee transportation or material movement, or for construction or maintenance work relating to transportation, including, but not limited to, passenger vehicles, heavy duty trucks, boats, trailers, motorized construction equipment, and “slip in” accessories or attachments that are used by more than one functional unit.

For further clarification of approvals (internal and external) related to equipment purchases, see the Department’s Acquisition Manual, which is available on the Administration Intranet web site.

Rental rates are established and maintained by the Division of Equipment and the Division of Accounting.

#### **4.01 License Requirements**

Supervisors shall ensure that each operator of equipment has a valid driver’s license and any special endorsements required for the specific type of equipment operated. Each supervisor shall maintain a file for each employee that contains the training records (electronic storage of training records is acceptable), and a current Department of Motor Vehicles (DMV) pull notice as required by the Biennial Inspection of Terminal (BIT) Program. Each DMV pull notice requires the supervisor’s signature and date received.

#### **4.01.1          Defensive Driver Training**

This is a mandated course for all employees who drive a State or personal vehicle on State business at least once every two (2) weeks. This course is required in accordance with the State Administrative Manual, Section 0751, and Management Memo 03-07, to be taken at least once every four (4) years. The Maintenance Field Defensive Driver Training, G21439, meets the Department of General Services, Office of Risk and Insurance Management mandated requirement for new and current field Maintenance/Equipment employees. This four (4) hour course incorporates California driving laws and Caltrans collision statistics and data, with driver safety instruction and a refresher on defensive driving rules and techniques. This course is for Maintenance/Equipment field employees. Employees who exhibit a need for additional training will be enrolled in an individualized State DDT course (one on one).

Note: As of June 16, 2003, the agreement between the Department of General Services, Office of Risk and Insurance Management, and the Department of Transportation, that exempted Maintenance employees from the Defensive Driver Training, if they attended the Maintenance Equipment Training Academy (META) every three (3) years, dated May 03, 1979, has been rescinded.

#### **4.02          Assignment of Equipment**

The District Equipment Manager shall continually analyze use of equipment assigned to a Maintenance region or area. The Equipment Manager shall move equipment within the district to affect the best usage possible.

Districts should use Integrated Maintenance Management System (IMMS) reports and Division of Equipment meter readings to aid in analysis of equipment use.

#### **4.03          Equipment Catalog**

The Division of Equipment (DOE) publishes a catalog of equipment available to the districts. This catalog was created to assist the Department in requesting the equipment best suited for the job. The catalog is available on the Division of Equipment Intranet web site. The catalog is updated as items are added or removed.

The majority of the available units of equipment are included in the catalog. With rare exceptions, all requests shall be from the catalog.

#### **4.04 Care and Responsibility of Mobile Fleet**

The Division of Equipment as the owning agency with responsibility for the purchase, maintenance, and repair of the Mobile Fleet, also has the following responsibilities:

Ensures that the equipment catalog developed by the Division of Equipment provides the Department with typical equipment and associated options to safely and efficiently maintain the State highway infrastructure. The equipment provided shall be of a size and configuration necessary to accomplish its intended task as safely and efficiently as possible, recognizing that quick and efficient operations on the travelway reduces employee exposure and traffic delays.

The Division of Equipment and the assigned equipment user are responsible for the care and proper use of all Mobile equipment from the time it is received until it is returned to the Division of Equipment.

The Division of Equipment is responsible for scheduled lubrication, preventative maintenance, and accurately maintaining service records. The Division of Equipment will notify equipment users of the next Preventative Maintenance due date. It is the responsibility of the user to notify the Division of Equipment in advance of any service needs prior to any pre-programmed service dates, and mutually arrange access for service. There may be occasions when Maintenance personnel will assist in servicing a vehicle.

The Division of Equipment is responsible for maintaining the fleet as it was originally provided in as good an operational condition as possible.

The Division of Equipment will provide the Department with a safe and functional equipment fleet that complies with all the requirements of the California Code of Regulations, California Vehicle Code, Cal-OSHA, and other regulatory agencies.

The Division of Equipment schedules all service and repair work to the Mobile Fleet as overall district priorities dictate. After performing repairs, the Division of Equipment representative shall inform the unit supervisor. The unit supervisor will normally arrange to have unit picked up promptly and returned to service. The Division of Equipment representative shall provide the unit supervisor repair documentation on the signed Repair Request. The Division of Equipment is also responsible for documenting all repairs and services in the Permanent Equipment Maintenance Record (PEMR), unless the repairs are made by the operator.

The Division of Equipment provides Divisions with a monthly State equipment rental expenditure report. This report shall be itemized at the cost center level.

The Division of Equipment provides Mobile Fleet equipment meter readings upon request.

Chief, Division of Maintenance

The Chief, Division of Maintenance, has the overall responsibility for the Division of Maintenance statewide. His responsibilities include the following:

- Evaluate the future needs of the Maintenance Division and prepare Budget Change Proposals as necessary.
- Establish and maintain a management system that efficiently utilizes equipment and funding resources to the fullest possible extent.
- Determine equipment resource allocations for the districts.

Chief, Office of Maintenance Equipment

The Office Chief of Maintenance Equipment reports to the Chief, Division of Maintenance and has the following responsibilities:

- Oversight of statewide safety training on equipment.
- Make recommendations regarding optimal allocation of equipment resources between districts by communicating with Deputy District Directors, Maintenance, or their designee.
- Anticipate future equipment needs by communicating with Deputy District Directors, Maintenance or their designees, and with other Division of Maintenance Office Chiefs.
- Evaluate existing policy and make recommendations for change when appropriate.
- Responsible for statewide fleet management and application of fleet standards.

Statewide Equipment Manager

The Statewide Equipment Manager reports to the Chief, Office of Maintenance Equipment, and has the following responsibilities:

- Provide information and consultation to the District Equipment Managers.
- Manage the statewide equipment pool.
- Review legislation that affects Maintenance Mobile Fleet and provide analysis.
- In conjunction with the Division of Equipment, monitor Inter-Agency Service Agreements (Form 13-A), and invoices.
- Monitor equipment rental (Object Code 007) expenditures statewide.
- Oversee statewide fleet to ascertain meeting of usage goals.
- Responsible for statewide fleet management and application of fleet standards.

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Deputy District Director, Maintenance

The Deputy District Director, Maintenance has the following responsibilities:

- Prepare and submit the annual Equipment Budget Requests (EBR).
- Is responsible for the equipment resource management within the districts.
- Keep the Chief, Division of Maintenance apprised of equipment resource utilization and, if necessary, make recommendations in researching and/or future equipment needs.
- Provide Division of Equipment's resident mechanics with safe, compliant, and functional facilities for the work conducted.

Field Maintenance Region Managers

The Field Maintenance Region Managers have the following responsibilities:

- Evaluate equipment availability and its impact on regional work plans.
- Plan, schedule, and effectively utilize the equipment fleet under regional control.
- Enforce compliance with all policies related to fleet management.
- Work with the Division of Equipment to set priorities for vehicle inspections and repairs for the Maintenance fleet.
- Review vehicle accident data pertinent to their regions and make recommendations and/or changes as needed.

District Equipment Managers

The District Equipment Managers have the following responsibilities:

- Make periodic field reviews observing the pre-trip/post-trip inspections of equipment by the crews and will inspect for general condition, unauthorized modifications, and general cleanliness. A report of these reviews will be made to district Maintenance management and to the local Shop Superintendent.
- Will provide input to district and Headquarters management on equipment needs identified by field Maintenance forces.
- Manage the district Maintenance equipment pool.
- Manage and move district equipment to meet usage goals.
- Help prioritize repairs for the Maintenance fleet.

Maintenance Area Superintendents

Maintenance Superintendents have the following responsibilities:

- Are responsible for the proper use and care of equipment assigned to their areas.
- Identify and arrange equipment training for operators and supervisors. Will support policies regarding operation, maintenance, and minor repair of equipment as taught to operators and supervisors at the Maintenance Equipment Training Academy (META).
- Shall enforce the use of the pre-trip/post-trip checklist book and Permanent Equipment Maintenance Record (PEMR) books.
- Will provide Division of Equipment personnel with equipment and access to Maintenance stations, and maintain safe, compliant, and functional facilities for work performed.
- Make every effort to work with the Division of Equipment and resident or Field Mechanics to set priorities for vehicle inspections and repair of the Maintenance fleet.

Maintenance Supervisors and Leadworkers

Maintenance Supervisors and Leadworkers have the following responsibilities:

- The Maintenance Supervisor, through the equipment operator, is responsible for shift inspection and minor preventive maintenance repairs. Operators are responsible for detecting the first signs of faulty equipment. They shall use the pre-trip/post trip checklist for reporting any signs of problems to their supervisors. The supervisor is responsible for making arrangements for repair.
- The pre-trip/post-trip checklist books are available through Material Operations Warehouse.
- Pre-trip inspections and post-trip checks shall be made and recorded on the pre-trip/post-trip checklist by each operator at the beginning and end of each shift. This requirement applies to all equipment rated  $\frac{3}{4}$  ton and larger. Units rated smaller than  $\frac{3}{4}$  ton shall have a pre-operational check once a week.
- If repairs are requested, trouble symptoms shall be recorded on the pre-trip checklist. If the repairs are minor and within the capability of the operator, the operator can make the repair, noting any repairs on the pre-trip form, and in the Permanent Equipment Maintenance Record (PEMR) book. If repairs are beyond the capability of the operator, the pre-trip checklist will be submitted to the supervisor. The supervisor shall decide to operate as is, or park and schedule the vehicle for repair. Operators shall follow the instructions on the pre-trip/post-trip book cover. The pre-trip/post-trip book shall be kept in or on the vehicle.

- Supervisors may only authorize the use of a vehicle with non-safety related defects until the date on the repair request portion. If there are safety-related defects, the supervisor will ground the vehicle until repairs are completed.
- Are responsible for the appearance and condition of equipment assigned to or used by their cost centers.
- Will enforce the policies of equipment operations, minor adjustments, and repair as instructed by META.
- Will ensure that personnel under their supervision follow prescribed Lube Folio instructions regarding proper servicing of equipment when required. Provide adequate cabinet or space to store a supply of parts and accessories for use by equipment operators.
- Provide proper storage for lubricants with correct product number decals on containers. Provide dust free storage for swing-spout oil dispensers.
- Will identify and advise management of operator training needs.
- Shall perform a safety inspection of each unit in his or her cost center. The safety inspection will be performed bi-annually, and the inspection date will be recorded in the PEMR book. When using pool assigned equipment, the supervisor will ensure that the inspection is current, and will perform an inspection if one is due. The PEMR book shall be kept with the vehicle.
- Provide Division of Equipment personnel with access to Maintenance stations and vehicles.
- Inform District Equipment Manager of all equipment transfers and movement.

### Operators

Operators (all employees who operate equipment) have the following responsibilities:

- Shall follow prescribed methods of equipment operation as instructed by META and their supervisors.
- Shall perform the required pre-trip/post-trip checks. Shall follow appropriate Lube Folio chart instructions for shift, 40 hour, or minor and major service when required (or use manufacturer's operator's manual if no Lube Chart exists), and shall log 40 hour services where designated on pre-trip form. Pre-op book covers provide specific record keeping instructions and shall be followed to ensure proper pre-trip and post-trip records are kept.

- The signature of the person making the pre-trip/post-trip checks is required in the space provided. The user shall also print his or her last name for identification purposes.
- Shall record major and minor vehicle service in the operator service section of the PEMR book, including the operator's initials in the space provided.
- A Permanent Equipment Maintenance Record book will be maintained for each piece of Mobile Fleet equipment and shall be kept in the equipment at all times. Major and minor servicing, repairs, brake adjustments, and inspections on the vehicle will be recorded in the book. The Division of Equipment supplies these books.

Operators are also responsible for making the following minor repairs and adjustments:

- Change light bulbs, fuses, and lenses.
- Simple adjustment or replacement of fan belts.
- Replace battery, cables, and clean battery connections when trained to do so.
- Replace wiper blades.
- Perform scheduled services when instructed to as outlined in the PEMR and/or Lubrication Interval Standards in File Section 10 of the Lube Folio, using the proper Lube Chart (or manufacturer's operator's manual if no Lube Chart exists) as a guide. Lube charts are available on the DOE web site.

The above in no way is meant to limit the operator to those repairs. He or she may make other minor repairs, but not modifications, as needed at the discretion of his or her supervisor with the approval of a Field Mechanic, Shop Supervisor, or District Shop Superintendent.

Equipment, which cannot be returned nightly to the Maintenance station must be parked in a safe place and be locked. Do not leave valuable parts unprotected if easily removable from the equipment.

#### **4.05 Transferring Equipment**

To ensure that equipment is used to the maximum extent possible and to meet usage goals, districts shall move equipment within their own district (intra-district), between other districts (inter-district), and to other State agencies when needed in accordance with established procedures.

Utilizing the Motor Pool Module of Fleet Management dispatching between districts and other Divisions may be arranged by the districts. Form DM-E87E shall be completed for each permanent transfer. The District Equipment Managers of the districts involved may handle inter-district movement of equipment. The local Shop Superintendents must be told of permanent transfers of equipment so proper location code changes can be made.

The Division of Maintenance, Statewide Equipment Manager can assist on inter- and intra-district moves, and may be involved in movement of equipment that involves the Division of Maintenance and other governmental agencies. Rental of equipment to or from other governmental agencies should be accomplished through use of an Inter-Agency Service Agreement and Invoice (Form 13A).

#### **4.06      Warning Lights**

Warning lights shall be provided for Maintenance vehicles which are routinely operated on the traveled way at lower traffic speeds and are not equipped with arrow boards. (Reference: Caltrans Safety Manual and Chapter 8 of Maintenance Manual, Volume 1).

Warning lights shall not be turned on when deadheading at prevailing speeds.

Units not regularly engaged in operations requiring amber lights may occasionally need portable warning lights not permanently mounted on the vehicle. These “plug-in” units will be supplied by the local Equipment Shop with a proper Local Request. Warning lights of this type will be supplied at the expense of the operating unit and will become its property. The Local Request must include the charge district, unit, and expenditure authorization. All Local Requests for portable warning lights for Maintenance will be approved by the District Equipment Manager. The local Equipment Shop will provide a dollar estimate for installation and associated costs, prior to approving the Local Request.

#### **4.07      Red Warning Lights**

Red warning lights are permitted only on an “authorized emergency vehicle” defined in Section 165 of the California Vehicle Code.

Department of Transportation vehicles classified as “emergency” are those complying with Section 165 of the Vehicle Code.

#### **4.08 Cost Responsibility-General**

In general, the Division of Equipment will furnish all typical motor vehicles and construction equipment. This equipment will be complete with accessories, devices, or services that are standard, ordinarily used, or legally required, and are provided as necessary in the operation of the unit. Available equipment units are in the Equipment Catalog along with a list of optional equipment.

#### **4.09 Local Request-Review**

Districts shall comply with the latest policies and procedures when unusual working conditions require special devices, accessories, or modification to units.

The requesting department shall provide appropriate charge codes to the Shop Superintendent for Local Request work.

When an item not listed in the catalog is requested, follow the approval process as outlined on Figure 4-1. All improvements or modifications become the property and repair responsibility of the Division of Equipment, with the exception of items defined as “plug ins” as in Section 4.06.

Improvements or modifications are sometimes required due to changes in the industry, or to enable a Mobile Fleet unit or its components to perform the functions for which they were originally intended. Examples of such improvements include larger engines, improved suspension, and retarder retrofits. Improvements or modifications are subject to the approval process. There shall be no improvements or modifications made to Mobile Fleet equipment except by the Division of Equipment employees or approved vendors, unless authorized by the Shop Superintendent or Headquarters Division of Equipment as appropriate.

All Requests for improvements or modifications to Mobile Fleet equipment from the operating Divisions must be supported by a properly justified and approved request with appropriate Expenditure Authorizations and Special Designations.

Any improvement or modification option requested for a Mobile Fleet unit that would require a Maintenance Class Number change shall be done with the concurrence of the appropriate Statewide Equipment Manager, Division of Equipment, Office of Shop Operations and Field Liaison, and Office of Fleet and Business Services prior to the work being accomplished.

See Figure 4-1 for a matrix that illustrates the responsible parties and appropriate actions to be taken when requesting modification or improvement of Mobile Fleet equipment.

### **Requests to Modify or Improve Mobile Fleet Equipment**

<b>ITEM/SITUATION</b>	<b>UNIT/ACTION</b>
Requests to retrofit Mobile Fleet units. With options listed in Equipment Catalog	<ol style="list-style-type: none"> <li>1. District Equipment Manager makes initial review and/or recommendation.</li> <li>2. Equipment Manager discusses with Shop Superintendent.</li> <li>3. Shop Superintendent provides estimates, recommendations and pursues needed approvals with the Division of Equipment. The Division of Equipment determines the delegated authority of the Shop Superintendent.</li> </ol>
Requests for non-catalog options, or improvements.	<ol style="list-style-type: none"> <li>1. District Equipment Manager makes initial review and/or recommendation.</li> <li>2. District Equipment Manager discusses with Shop Superintendent; proper charge is determined.</li> <li>3. Shop Superintendent provides recommendations, estimates, and pursues needed approvals with the Division of Equipment. The Division of Equipment. Determines the delegated authority of the Shop Superintendent.</li> </ol>

Figure 4-1: Requests to Modify or Improve Mobile Fleet Equipment

There shall be no modifications or improvements of Caltrans Mobile Fleet equipment that is nearly obsolete or nearing replacement unless legally required to keep the unit in operation.

Any repair work done on district owned non-Mobile Fleet or Maintenance equipment such as lawn mowers, small pumps, and chain saws is not the responsibility of the Division of Equipment, and shall be arranged by Maintenance through private vendors or other means.

There shall be no modifications or additions made to Caltrans Mobile Fleet Equipment by Caltrans Maintenance employees unless approved by the Division of Equipment, or as delegated to the Shop Superintendent and District Equipment Manager.

#### **4.10 Lost or Stolen Accessories**

The cost or replacement of lost or stolen accessories or loss due to theft, vandalism, abuse, or neglect while such equipment is in the possession of a district shall be charged to the Division.

Disciplinary action may be taken when damage or loss is a result of neglect or operator abuse.

#### **4.11 Changes in Location of Accessories.**

Accessories and equipment that are the property of the Division of Equipment are not to be altered or moved from one vehicle to another without first complying with requirements of Section 4.09.

#### **4.12 Repair**

One of the main functions of the Division of Equipment is to perform all necessary repairs to equipment. These repairs will be made promptly by one of the Division of Equipment shops, or the shop may give authorization to have the work accomplished in a suitably equipped commercial shop. For minor repairs, authorization may be given to Maintenance Division employees to perform the work.

A Shop Superintendent of Equipment has authority to request release of equipment for repairs when, in his or her opinion, the equipment should be removed from service to prevent progressive mechanical damage. During an emergency, an Equipment Shop Superintendent may permit continued use of equipment despite this damage if a district is unable to make satisfactory substitution.

#### **4.13 Inspection of Steam Boilers and Unfired Pressure Vessels**

Every steam boiler or unfired pressure vessel must be inspected at designated intervals if it is over six (6) inches in diameter, has a holding volume of more than one and one half cubic feet, or operates at more than 30 pounds pressure per square inch. The inspector must have a certificate of competency issued by the Department of Industrial Relations, Division of Industrial Safety.

Steam boilers and unfired pressure vessels inspections on Mobile Equipment are to be handled through the Division of Equipment. Districts are responsible for all other steam boilers and unfired pressure vessels and shall ensure that these inspections are done.

Operators shall drain air tanks completely of accumulated moisture at least once during each shift of operation. Air brake reservoirs must be drained to remove moisture and contaminants, even when a tank is equipped with an air dryer. To ensure the proper function of one-way check valves on dual brake system, tanks must be drained in the following order:

- (A) Supply (wet) reservoir.
- (B) Front service reservoir.
- (C) Rear service reservoir.

Drain each completely before closing drain valve and proceeding to the next. If any reservoir is empty when a valve is first opened (with engine off and system charged), the brake system may be defective. Notify supervisor or Equipment Shop staff before further operation.

#### **4.14 Overweight or Oversize Loads**

State equipment carrying overweight or oversize loads must carry a transportation permit authorizing the movement. Annual permits for Maintenance and other Divisions can be obtained through the Office of Commercial Vehicle Operations and Permits.

#### **4.15 Fire Extinguisher on Equipment**

- (A) Fuel trucks, paint stripers, and asphalt kettles shall be equipped with a 20:BC rated dry chemical or carbon dioxide fire extinguisher.
- (B) Any truck or truck-tractor used to transport hazardous materials shall be equipped with a fire extinguisher having a rating of 10:BC or more.
- (C) Any truck or tractor-trailer combination exceeding 40 feet in length will require a fire extinguisher having a rating of 5:BC or more.
- (D) Any 3-axle truck will require a fire extinguisher having a rating of 5:BC or more.
- (E) Any truck or bus used primarily for hauling seven (7) or more employees to and from the job site will require a fire extinguisher having a rating of 4:BC or more.
- (F) All tow trucks will require a fire extinguisher having a rating of 4:BC or more.

- (G) All certifiable mobile cranes shall have a fire extinguisher rated at 5:BC or more, readily accessible to the operator station.
- (H) All personnel lifts shall be equipped with a fire extinguisher having a rating of 5:BC or more, to be located in truck cab.
- (I) Fire extinguishers are required to be visually inspected during pre-trip inspection by the operator. They should be serviced and tested every five (5) years. Functional units are responsible for the service and testing costs.
- (J) Alternate equivalent protection shall be provided when portable extinguishers are removed from service for maintenance and recharging.
- (K) Where portable extinguishers have been provided for employee use in the workplace, an educational program shall be provided by the functional unit to familiarize employees with the general principles of fire extinguisher use, and fire fighting hazards.

#### **4.16 Use of State Vehicle**

Board of Control Rule 847(D) requires that State employees who frequently store State vehicles at or near their residences must have a Home Storage Permit. The district office can provide further information about this requirement, and the process for obtaining a Home Storage Permit.

#### **4.17 Rental of Non-State-owned Equipment**

When equipment is not available from within Caltrans, the Division of Equipment is required to make the effort to obtain equipment from another governmental agency prior to renting from a non-governmental source.

Equipment rented un-operated or fully operated and maintained must meet the minimum safety requirements established by Cal/OSHA.

Authority to rent equipment is delegated to the districts in conformance with the following procedures:

- (A) Equipment is not Within Immediate Area

If needed equipment is not available in the immediate area, notify the District Equipment Manager. He or she will look for the units within the district.

**(B) Equipment is not Within the District**

If the equipment is not available in the district, the District Equipment Manager shall look statewide for Caltrans equipment or for equipment from other governmental agencies. The Division of Maintenance Statewide Equipment Manager will assist in this search.

**(C) Equipment not Within Caltrans or Other Governmental Agencies**

If the equipment is not available within Caltrans or other governmental agencies using district procedures, prepare an equipment rental contract or the Equipment Manager may use his or her Equipment Rental Calcard. Make every effort to obtain rented equipment un-operated. The contract should include a justification that indicates the efforts made to obtain equipment either through Caltrans or another government agency. The contract should also include an approval signature by the District Equipment Manager.

The Division of Equipment is not responsible for any repairs to rented equipment. Transporting and repairs should be included in the contract and provided by the rental agency.

There are two basic principles involved in considering use of contract equipment:

- (1) Use Caltrans or other governmentally owned equipment whenever it is reasonably available for maintenance work.
- (2) Do not rent operated equipment to do work that is the normal function of Maintenance employees.

When looking for needed equipment, always work through your District Equipment Manager. He or she will make the required contacts.

Equipment rental contracts should not be requested for the rental of haul trucks to haul materials such as asphalt concrete, cinders, sand, and aggregate. Such materials purchased from a vendor should be delivered by the vendor, or by State forces utilizing State owned equipment. Vendor delivery is generally the preferred approach.

An emergency condition is defined as an unforeseen happening or state of affairs requiring prompt action to protect the health, safety, and welfare of the public. Emergency work is defined as remedial measures required to immediately avert, alleviate, repair, or restore damaged property having a public and State interest.

An emergency situation, however, does not relieve Caltrans of the requirement to look at its equipment as well as that of other governmental agencies prior to obtaining an outside rental. A copy of all equipment rental contracts shall be forwarded to the Division of Maintenance Equipment Manager, who is also responsible to forward the required notification of rental to the Department of General Services.

To expedite the rental of equipment, the district should advertise quarterly for and maintain a current bidders' list of equipment normally rented by the district. This procedure will drastically reduce time required to process an equipment rental.

Equipment rental should be minimized whenever possible through proper scheduling of work and sharing of equipment.

#### **4.18 Towing Equipment**

No equipment shall be towed on the traveled way at road speeds when the weight of the towed unit is more than the towing vehicle, unless the towed unit is equipped with brakes controlled by the towing vehicle. The drawbar or chain length should not exceed 15 feet, and the vehicle cannot be towed with a chain beyond the nearest exit from a freeway. (CVC 29005-29006).

#### **4.19 Maintenance Equipment Training Academy**

The Maintenance Equipment Training Academy (META) is the Caltrans Equipment Operator training program located at McClellan Park in Northern California.

All Caltrans Maintenance personnel whose duties include operation of equipment, and their supervisors, are required to attend the training facility and learn the basic fundamentals for the proper inspection, preventive maintenance, service, and operation of Caltrans equipment.

The training program includes a mix of classroom, laboratory, and "hands on" equipment operating time.

#### **4.20 Equipment Budget**

The District Shop Superintendent has responsibility for preparation and submission of the annual District Equipment Budget including Maintenance.

Each District shall include complete a self-supporting justification for each addition, upgrade or downgrade, change in mix, or replacement request that is included on the Equipment Budget Request (EBR). There may be special exemptions or justifications needed (e.g. Air/Water Quality Districts).

In addition, the following shall be accomplished before submitting a budget item:

- (A) Identify all units of equipment previously requested and approved that are in process or already purchased, but have not yet been received in the district. Forward a copy of this list to the Headquarters Division of Maintenance.
- (B) Fully describe the circumstances that have created the need for upgrade, change in mix, or additional equipment, including the estimated dollar and person year savings, and potential change in rental costs.

Describe why a piece of equipment that meets disposal criteria and is proposed for replacement cannot be eliminated from the fleet.

- (C) Deputy District Directors, Maintenance and District Equipment Managers should consult the Maintenance Region Manager regarding the equipment needs for Area Superintendent areas, based on the number and types of equipment required to effectively accomplish the total workload. This should take into account the Area Superintendent's present equipment inventory, equipment "in process" but not yet received, units predicted for disposal, and district and Headquarters pool units available on a loan basis. This process should separate true "needs" from "wants."
- (D) Permanent transfer of low usage units and increased sharing within the district shall be considered before a request for equipment is submitted.
- (E) Question each special attachment or feature to be provided with a requested unit.  
  
Anything added increases initial cost, and may require a larger vehicle, thereby further increasing initial cost, operating cost, and fuel consumption. Offsetting benefits should be quantified whenever possible.
- (F) Consult with the District Shop Superintendent regarding how special features will affect the size and weight of requested units. Avoid requesting larger units not compatible with the existing fleet.
- (G) Requests for equipment which are found to be incomplete and/or lack justification will be disapproved in the Division of Maintenance Equipment Budget Request review process.
- (H) Comply with any other special Equipment Budget Request instructions used by the Division of Maintenance.

All Mobile Equipment, except in very rare cases, shall be ordered from the Caltrans Equipment Catalog in accordance with Department of General Services and Departmental procurement procedures. See the Department's Acquisition Manual for details.

#### **4.21     Parking**

No vehicle shall be left by the driver without first engaging the transmission into the lowest gear, unless otherwise instructed in the operator's manual. In the case of some automatic transmission equipped vehicles, put vehicle into park, apply the parking brake, and shut off the engine.

Dozer blades, log grapples, tongs, and buckets on front end loaders, elevating dump bodies, and other components capable of vertical movement by gravity shall be lowered to the ground, blocked, or set on a solid support when the machine is parked. Such components shall be mechanically locked or securely blocked to prevent movement before employees are permitted to perform any work on them.

The use of chock blocks with vehicles other than aerial lift units is an option of district management.

A standard chock block configuration has been established and is shown in plate 4-2 at the end of this chapter. Those districts that have an established chock block policy shall supply and use the standard chock blocks for their vehicles. All new vehicles coming into service will have chock block holders that will match the chock blocks shown in Figure 4-2. These are to be installed by the Division of Equipment using the Local Request procedure as outlined in section 4.09.

#### **4.22     Operator Qualification**

Operator qualification testing and training is administered by META. Qualification modules exist for most equipment in the Caltrans fleet.

Equipment for which modules exist can only be operated by qualified and properly licensed operators. Equipment for which modules do not exist can be operated if the operator is properly licensed, trained, and has the proper position classification.

The Qualification Program includes time for training in order to prepare for the required testing.

#### **4.23 Abnormal Equipment Failure**

Guidelines and reporting information procedures can be found on form DM-E 253 (Rev. 4/98).

The identification of the failure can be made by Maintenance or the Division of Equipment. However, the record of discovery on form DM-E 253 (Rev 4/98) will be signed off by both the District Shop Superintendent and the District Equipment Manager.

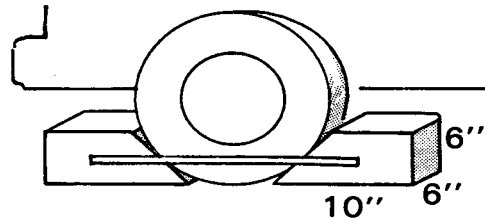
It is the responsibility of the District Equipment Manager to consult with the functional unit manager to pursue the investigation and report findings.

The Deputy District Director, Maintenance has the responsibility to pursue the investigation and report the findings to the Chief, Division of Maintenance.

These guidelines supersede all previous directions and/or policy and procedures.

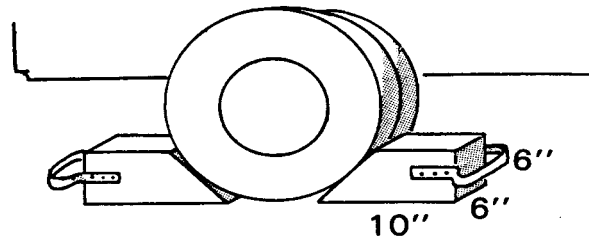
### Use of Chock Blocks

Figure 1



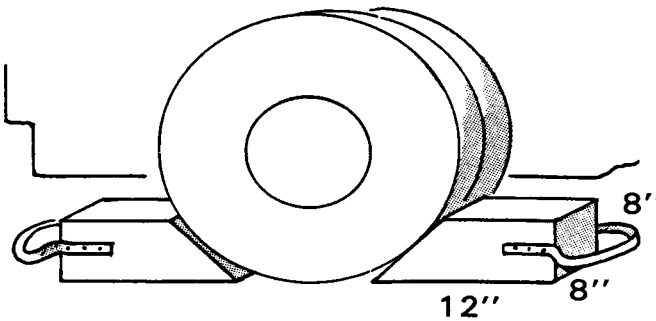
6" x 6" x 10"  
@ 45°

Figure 2



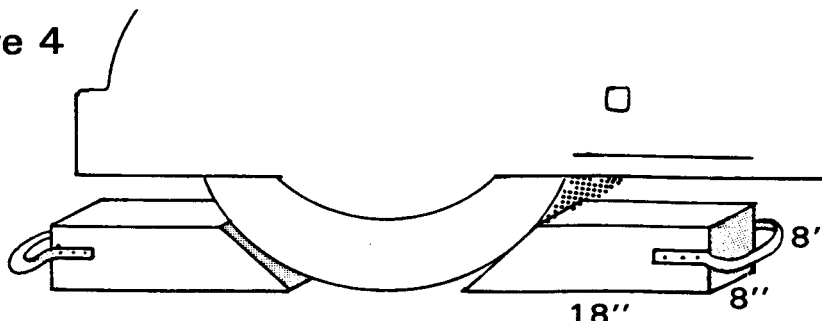
1 Ton  
6" x 6" x 10"  
@ 45°

Figure 3



1 1/2 Ton  
& over  
8" x 8" x 12"  
@ 45°

Figure 4



Iron Wheel  
Roller  
8" x 8" x 18"  
@ 30°

Figure 4-2: Use of Chock Blocks

# **CHAPTER 5**

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5.02	Permit to Possess Explosives

*Original signed by*

Nate Cradle

Office of Maintenance Equipment and Training

Division of Maintenance

## **5.00 Introduction**

All explosives are dangerous and must be handled and used with extreme care. The term "explosives" is defined as any chemical compound, mixture or device, which is to function by explosion, i.e., with substantially instantaneous release of gas and heat. The term "explosives" shall include, but not be limited to, blasting agents, blasting caps, electric blasting caps, detonating fuse, and projectiles. The handling and moving of explosives and the mixing of blasting agents shall be performed exclusively, by experienced personnel. Dynamite, nitroglycerine, or black powder shall not be used by Caltrans employees because of the extreme hazard involved.

Blasting operations shall neither be permitted nor required unless a competent blaster, having a valid California Blaster's License and a Caltrans Blaster's Certificate, is physically present on the site. Blasting operations shall be under the control of the licensed blaster at all times. All licensed blasters shall attend annual training to maintain their proficiency and certification.

Supervisors and licensed blasters shall be furnished copies of the Caltrans Maintenance Blasters Manual and the Construction and General Industrial Safety Orders of the Division of Industrial Relations (CAL/OSHA), referring to "Explosives." They should also be furnished copies of State and Federal regulations and local ordinances applying to use, handling, and storage of explosives. They shall periodically review the Caltrans Maintenance Blasters Manual and the Construction and General Industrial Safety Orders to assure that all applicable regulations are being followed.

## **5.01 Avalanche Control**

Various explosive projectiles, as well as ordinary explosives, are used to control avalanches. As with ordinary blasting, a competent licensed blaster shall be physically present on site to supervise the operation.

## **5.02 Permit to Possess Explosives**

No person shall store, handle, or transport explosives or blasting agents except under a valid permit issued by the applicable Federal, State, or local agency. Application for a permit shall be made to the appropriate issuing authority in the jurisdiction in the area of activity, i.e., chief of police or sheriff. If explosives are to be used or stored in a jurisdiction other than that of purchase, the permit shall be so endorsed by the issuing authority.

# CHAPTER 6

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Original signed by

Shakir Shatnawi

Office of Pavement Maintenance Standards

Division of Maintenance

## **6.00 Introduction**

While it is most economical to use local materials when possible in maintenance work, results will not be satisfactory unless suitable materials are used. Superintendents and supervisors are not expected to be familiar with all materials tests, or with the full details of sampling required on a major project. However, it is important that the person in charge of work be familiar with routine sampling procedures.

This chapter focuses on sampling and testing of materials. To learn more about products used, typical applications, and expected performance, refer to the “Maintenance Advisory Guide”, which is a complete technical document of materials and strategies.

## **6.01 Sampling**

It is critical that samples of materials submitted to the Laboratory for testing be representative. Construction based on misleading test data may fail completely, or inexpensive suitable material may be unnecessarily excluded from use.

Use Chapter 8 of the Construction Manual as a guide to sampling procedures and sampling frequency.

Often, the quantities of some materials required on a maintenance project may be very small, or the intended use of the material may be such that strict quality controls are not feasible. Consult the District Materials Laboratory or Office of Materials, Engineering, and Testing Services (METS) when questions arise regarding sampling and testing.

When materials are purchased in large volumes for stockpiling, or when a local source of aggregate is being considered for use, it may be advantageous to request assistance from the district, or from METS. Proper equipment and trained personnel can often save both time and money in the sampling and testing program.

## **6.02 Sample Identification**

Each sample submitted to the laboratory for testing must be accompanied by a sample identification form. Three types of forms are used:

- Form TL-518 for cement samples
- Form TL-502 for field concrete samples
- Form TL-101 for all other materials

Instructions for using the forms are printed on the cover of the book containing the forms. Each item on the sample identification form should be filled out completely. A completed form provides the required information on the project, the material and where sampled, the type of tests to be performed, and the date test results are required.

TransLab requests that particular attention be directed to the following details:

- (A) Use a black ball-point pen, or pencil of sufficient hardness to produce clear carbon copies.
- (B) Submit the original (white) copy to the laboratory where testing is being done. The original should accompany the sample, provided adequate precautions are taken to protect from mutilation or water and oil stains. Waterproof envelopes (Material Operations Catalog No. 7510-1140-6) will normally provide adequate protection. If adequate protection cannot be assured, the original (white) copy should be mailed to the laboratory on the same day the samples are shipped. The normal procedure for reporting test results is to reproduce the laboratory work card with the identification form attached. Only the white copy of the form, completed in black pencil or pen, will consistently provide readable reproductions.
- (C) The sample ticket should indicate the use for which the material is intended in order that the proper tests will be performed.

The Caltrans Maintenance representative should inform the laboratory of field conditions pertinent to the sample by entering such notes under “Remarks” on the same identification form. These conditions may involve difficulties with compaction, rolling, raveling, or degradation. If applicable, this section should also include information regarding weather, moisture, traffic, and similar conditions to convey the Maintenance person’s field observations to the laboratory. In cases where the Maintenance person is reasonably sure that the material is suspect in only one or two of the specification requirements, he or she should note this on the sample identification form. This will prevent the expense of unnecessary testing.

### **6.03      Priority Testing of Samples**

Schedule sampling of materials far enough in advance of the work to allow necessary testing prior to use of the material. It is inevitable that there will be occasions when advance testing is not possible. When situations arise where immediate testing is necessary to avoid delays in the work, the TL-101 forms should be marked “priority” under the entry for “Date Test Results Desired”. This will alert the laboratory to give the sample special handling. Be sure to include a telephone number in the remarks column of TL-101 if a priority request includes telephone notification.

Do not enter “priority” on the form unless there is a true need to expedite the process. Plan ahead when possible to avoid the need to for special handling of samples.

### **6.04      Receiving of Materials**

The Caltrans Maintenance Area Superintendent should assign someone the responsibility for checking shipments of materials when they are received and making sure that all have been properly inspected and released. Inspected material may be identified by inspection tags (Form TL-624), or a lot number on the package. An inspection report (Form TL-29) should be received within a week or ten days after delivery.

Contact METS promptly when receiving shipments not covered by releases so the necessary investigation can be made.

If this investigation is delayed too long, the process of identifying and checking on the shipment may be extremely difficult.

### **6.05      Shipping of Samples**

When shipping samples from the job to the District Materials Laboratory and/or METS, use the most economical mode of transportation that will meet time frame requirements.

### **6.06 Sampling Failures of Existing Bituminous Surfaces**

To determine the causes of roadway failures on existing pavements, be sure to obtain samples from both stable and unstable areas. Pavement cores are sufficient samples in some cases. In other cases, additional material should be submitted in sealed containers to test for moisture content on existing material. Consult the TransLab Pavement Consulting Services Branch for assistance when making these decisions.

The following samples should be sufficient for tests to analyze the average surface failure:

(A) From a stable area:

- (1) One (1) gallon can (sealed).
- (2) Approximately 25 pounds in canvas bag or other container or sufficient cores.

(B) From an unstable area:

- (1) One (1) gallon can (sealed).
- (2) Approximately 25 pounds in canvas bag or other container or sufficient cores.

Indicate on the Sample Identification Card (Form TL-101) the type of failure such as raveling, instability or cracking of the surface. Provide a letter giving additional details such as intensity of traffic, condition of base material, and date and weather conditions at time of construction. This will greatly help to properly analyze the cause of failure.

### **6.07 Paving Asphalts**

A sample representative of the asphalt actually entering into the mix shall be taken from the asphalt line leading from the storage tank to the mixer, or from the storage tank by means of an oil thief. The following procedure shall be followed when obtaining the samples.

All sampling operations involving hot asphalt must be performed with care to avoid burns from spilled material or a possible flash from vapors collecting in storage tanks. There is always the possibility that any asphalt may be delivered to the job site at temperatures sufficiently high to cause the collection of flammable vapors in the storage tank. These vapors may flash if the correct mixture with air should occur, and a spark or other ignition source is present. No smoking is permitted while sampling paving asphalt regardless of procedure used.

No sampling shall be done during transfer operations. Gloves shall always be worn, and sleeves rolled down and fastened at the wrists while sampling.

The recommended method of obtaining the sample is from a valve placed in the line leading from the storage tank to the mixer. The sample shall be drawn from the valve after completion of transfer and sufficient circulation of the contents of the storage tank. This assures that the sample represents the contents of the tank. At least one-half gallon of asphalt shall be drawn from the valve prior to obtaining the sample. Sample from the spigot only, using a one-quart sample can supplied by the District Materials Laboratory.

The above described procedures shall be followed for each truck delivery that occurs when a State representative is present at the plant. When a number of loads are transferred to the storage tank during the night, a sample shall be obtained shortly after the start of plant operations on the following day. If such loads are discharged into more than one storage unit, then each tank should be sampled after the plant begins to draw from the storage unit.

After obtaining a sample from the plant storage tank, the sampler shall write the shipment number representing the loads placed in the tank prior to sampling on the TL-101 sample ticket. If the sample represents more than one load, be sure that all of the DL-TL-331 shipment numbers are shown on the TL-101. This is very important because the shipment can be identified only when the shipment number is known.

See test #125 and Section 8 in Construction Manual (Size and Frequency of Sampling).

In cases where paving asphalts are being used for seal coat work, a sample shall be drawn after one-half of the contents of the distributor has been placed. The sample may be drawn from either the spreader bar, or from the dome opening. Under no circumstances shall a sample be taken from any loading lines, hoses, spreader bars, etc., until sufficient material has flowed through such lines. Small amounts of fuel oil or other grades of asphalt remaining in the lines from previous loads will badly contaminate a small sample withdrawn when discharging begins.

All samples of asphalt, together with the necessary forms and tickets, shall be packed and shipped to the appropriate laboratory each day, or as they are taken. The sample cans may be packed and shipped two at a time in the cardboard cartons used for shipping samples of the completed mix.

### **6.08 Liquid Asphalts**

Sampling of liquid asphalts shall be performed in the same manner as detailed for the paving asphalts, with the following added precautions:

Extreme care should be taken in sampling transport or spreader units loaded with cutbacks or slow-curing products. No smoking should be permitted by anyone in the immediate vicinity while the sample is being taken.

After sampling of cutbacks, the top of the sample can shall be screwed on tightly and checked for tightness after the sample has cooled off prior to shipment. A small loss of volatiles from a 1 quart sample will cause marked changes in the consistency of the material.

### **6.09 Asphaltic Emulsion**

Emulsion should be sampled in the same manner as other asphaltic products, except for the following:

Before lowering the thief into the material to be sampled, the sampler should push any scum on the surface of the emulsion away from the area where the thief is lowered.

The sample should always be poured into a clean plastic container for shipment to the laboratory. One-half gallon of emulsion is ordinarily sufficient for regular routine tests; however, when difficulty is experienced with the emulsion on the job, or there is some reason to believe that the material does not comply with specifications, submit two one-half gallon samples. This quantity will furnish sufficient material for any special tests that may be desired. Use one-half gallon containers supplied by the District Materials Lab for sampling emulsion.

### **6.10 Asphalt Concrete**

Obtain a representative sample of the completed mixture from the mat behind the paving machine. The frequency of such testing is shown in Section 8-01 of the Construction Manual.

Each sample shall be taken before breakdown rolling is performed. The sample shall be obtained by removing a minimum of four shovels full from the full depth of the mat. Each shovel full is to be taken from a random point in a line transversely across the mat. The material should be thoroughly combined while it is still hot, then quartered to obtain the required 15 pound sample. Fifteen pounds of asphalt concrete is the approximate weight of one full cardboard carton of the size furnished in the field for the purpose. Open graded asphalt concrete and asphalt treated permeable base shall be obtained from the paver receiving hopper.

Under no circumstances should the shovels full of sample material be taken from the top or edges of the pile in the truck, the windrow, or from the hopper of the paving machine.

Identify the samples to indicate both the stationing where they were taken and the approximate area they represent. Mark all "Acceptance Sample" for priority testing. Complete the Form TL-101, adhering to the instructions printed in the book containing the forms and information on "Sample Identification" contained in Section 8-01 of the Construction Manual.

It is essential to record the type of mix, grade and source of asphalt, and percent of asphalt used in the mixture. Do not forget to include whether the sample is for "Acceptance", "Independent Assurance", or "Special" testing.

Contact Construction if nuclear gages are to be used for in-place densities. Nuclear gages (California Test 375) are often used to determine the in-place density and relative compaction of AC pavements. If a nuclear gage is not available, samples of the compacted pavement may be taken from the street at the discretion of the engineer. Samplers shall use extreme care in removing the sample and packing it for shipment in order to prevent the sample from breaking or falling apart. Wherever facilities are available, the density of the sample should be obtained in the field and noted on the TL-101 form, to eliminate the necessity for careful packing.

It is essential that the compacted sample and the uncompacted sample of the mix, be obtained from the same load in order to compare the density of the compacted field mix and the laboratory compacted specimens.

### **6.11 Road-Mixed Asphalt Surfacing**

Road-mixed surfacing material should be sampled after the material has been laid out. Sampling from the windrow is permissible if the sampler is certain that the oil is thoroughly mixed with the aggregate, and that the sample will be truly representative.

### **6.12 Paint**

See Section B of the Construction Manual (Frequency of Testing).

All paint manufactured under State specifications is sampled at the factory, tested by the Laboratory, and properly identified by lot numbers before being shipped to the job. Occasionally, when shipment is required to the job before tests can be completed, the manufacturer is allowed to make shipments at his own risk pending laboratory report. The shipment of paint under these circumstances is not to be construed as an acceptance.

It is merely an expedient to save time when necessary. Report of Inspection of Material (Form TL-29) will be issued to interested parties if acceptance is made by the laboratory.

Some of the paint manufacturers stock a limited supply of Laboratory approved specification paints identified by lot numbers ready for immediate shipment on order from the contractor. Report of Inspection of Material, Form TL-29 will be issued whenever shipments of this nature are made.

Samples of paint from the field should be sent to the laboratory as soon as the paint is received on the project. This is to determine if any change has developed in the product since its inspection by the laboratory. During the progress of the job, take special check samples of the paint when the paint exhibits hard settling, when the engineer suspects tampering with the paint, or at any other time at the discretion of the engineer.

Proper sampling to obtain a representative portion of the paint is absolutely mandatory. Sampling in the field must follow this method:

- (A) For bridges and other major structures, or whenever large quantities are involved, send an unopened 5 gallon can to the TransLab for testing. Unused portions will be returned to the job.
- (B) For smaller samples:
  - (1) Pour the top liquid into a clean container as large as the one being sampled.
  - (2) Stir the settled portion of the paint with a paddle, gradually reincorporating the decanted liquid a little at a time until all has been added.
  - (3) "Box" the paint by pouring it back and forth between the two containers at least five (5) times, or until the paint is mixed thoroughly.
  - (4) Take a quart sample immediately.

Send all samples to the laboratory promptly, along with all pertinent information regarding them. Use Form TL-101. Paint which has thickened due to low temperature shall not be thinned. The contractor should warm the paint to thin it for proper application.

When the paint is State-furnished, check samples will not be required.

Samples of paint from the field should be sent to the Laboratory without delay when:

- (A) The paint has not been previously tested, in which case it should not be used until release is made by the Laboratory.
- (B) The paint has been purchased locally.
- (C) At the beginning of the job for check purposes unless the paint is State-furnished. In this case, no check sample is required.
- (D) During the progress of the job, check samples may be taken at the discretion of the engineer. Samples taken from the painter's bucket or from the spray nozzle are normally not suitable for accepting or rejecting paints.

A limited amount of field inspection to determine if the paint is properly mixed may be made by obtaining the weight of a calibrated container of paint and comparing this weight with the specified weight per gallon. It is difficult to detect the addition of small amounts of thinner by field tests. If the addition of thinner is suspected, field samples should be forwarded to the Laboratory.

All essential data should be included with the sample on Form TL-101 covering identification, lot number, manufacturer's formula number, manufacturer's brand and formula number, whether or not purchased locally, nature of trouble, and any other pertinent data.

# **CHAPTER 7**

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Original signed by  
Patti-Jo Dickinson  
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## **7.00 Introduction**

It is the policy of the Maintenance Program to keep State highways open to traffic and to provide for safe movement. Maintenance operations may be varied to meet climatic conditions, location, and volume of traffic. The first consideration is for the safety and convenience of traffic during either routine or emergency work.

Personnel responsible for maintenance operations on highways where non-motorized (bicycle/pedestrian) travel is permitted should ensure that bicyclists and pedestrians have a safe and reasonably direct route through or around the work area.

For additional information about non-motorized considerations, please refer to Chapter “A” (Flexible Pavement), Chapter “C2” (Vegetation Control), Chapter “C5” (Drainage Facilities, Fences, and Roadside Appurtenances), and Chapter “D1” (Litter, Debris, and Graffiti).

On heavily traveled freeways, lane closures can cause severe congestion and result in accidents and delays to the traffic. Before any work is done on a highway which requires closing of one or more lanes, careful consideration must be given to the effects the operation will have on traffic. Caltrans minimizes traveler delays when implementing projects or performing other activities on the State highway system. This should be accomplished without compromising public safety, worker safety, or the quality of the work being performed. A Traffic Management Plan (TMP), when implemented, results in minimized project related delays and accidents. The District Traffic Manager acts as the single focal point for all traffic impact decisions resulting from planned activities on the State highway system. Maintenance personnel responsible for implementing lane closures should be familiar with Deputy Directive 60 (Traffic Management Plans), the TMP requirements for their district, and know their District Traffic Manager. During an emergency, the most important things should be done first; protect the public and employees. Then, consideration should be given to either save the highway or structure, or provide a temporary road for traffic. Traffic should be protected at slides, slip outs, washouts, or repair work affecting the traveled way by placing appropriate signs or barriers, supplemented at night by warning lights. Maintenance personnel should provide advanced notice of planned closures of separate bicycle/pedestrian paths in the right of way, when possible, by erecting signs along the path as soon as the schedule for the closure is determined.

Caltrans has the authority to close any State highway to protect the public or to protect the highway from damage during storms. The highway may also be closed during construction or maintenance operations. The California Highway Patrol (CHP) is authorized to direct traffic, which includes stopping or expediting traffic for any purpose that will ensure safety. Stopping traffic could be the result of road failures, severe traffic conditions resulting from accidents, severe weather conditions resulting from heavy snow or rainfall, or any other phenomenon that would endanger traffic using the highway.

The Traffic Manual has been replaced by the Federal Highways Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) as amended by the most current version of the California Supplement to the MUTCD (Supplement), herein referred to as the MUTCD and the CA Supplement. Contact the Division of Traffic Operations or the Division of Maintenance for additional information or advice on the MUTCD and the CA Supplement. Attention is directed to the Division of Traffic Operation homepage for the Office of Signs, Markings and Permits.

Signs referenced with (CA) in this chapter indicate a California sign code. Otherwise, the sign code referenced is a federal sign code.

### **7.01 Cooperation with the California Highway Patrol**

CHP and Caltrans have a Joint Operations Policy Statement that functions as a guide for joint activities on State highways. CHP has furnished the following statement in response to our inquiry regarding their handling of accidents and Vehicle Code violations in vicinity of work being done on the highway by employees of Caltrans:

It is recognized that Department of Transportation employees are often called upon to work under hazardous conditions and their safety is jeopardized by any careless or incompetent driver. They must depend upon the operators of passing motor vehicles to observe the provisions of law which have been established for their protection.

The California Highway Patrol recognizes the danger presented by careless and incompetent drivers. Since CHP officers are responsible for the enforcement of the Vehicle Code and other laws relating to vehicle traffic, they will do everything in their power to apprehend and prosecute violators. In addition, they wish to be advised of unusually hazardous conditions prior to an accident occurring.

After an accident has occurred, an officer cannot issue a citation for a misdemeanor that was not committed in his or her presence (Penal Code 836). If the investigation and the statement of witnesses and victims indicate a violation, a complaint will be filed in the appropriate court and a warrant issued. At trial, it is necessary for the witnesses and victim to testify in court and identify the violator. A citation will be issued at the scene when an accident occurs and a traffic violation is personally observed by an officer. In cases of hazardous driving not resulting in an accident, a Caltrans employee who thinks prosecution is required must sign a complaint in the appropriate court. Accident complaints are subject to approval of the local District Attorney in many areas.

Maintenance personnel who are in the vicinity of an accident should cooperate with the investigating officer in every way possible to see that the officer obtains the necessary evidence to support a complaint and prosecution of violators. Maintenance personnel should be alert to get names, addresses, and license numbers of possible witnesses to aid in successful prosecution.

CHP, upon receipt of inquiries of Maintenance Supervisors, Superintendents, or other Caltrans officials, will explain the results of their investigation in any accident involving highway equipment or personnel, and their reasons for the issuing or not issuing a complaint against the violator.

## **7.02 Highway Closure Notification**

### Streets and Highway Code

124. The department may restrict the use of, or close, any State highway whenever the department considers such closing or restriction of use necessary:

- (a) For the protection of the public.
- (b) For the protection of such highway from damage during storms or during construction, improvement or maintenance operations thereon.

125. To notify the public that a state highway is closed or its use restricted, the department may:

- (a) Erect suitable barriers or obstructions upon such highway.
- (b) Post warnings and notices of the condition of any such highway.
- (c) Post signs for the direction of traffic upon it, or to or upon any other highway or detour open to public travel.
- (d) Place warning devices on such highway.
- (e) Assign a flagger to warn, detour, or direct traffic on such highway.

127. The California Highway Patrol shall cooperate with the Department in the enforcement of the closing, or restriction of use, of any State highway.

Vehicle Code

21370. The Department of Transportation, or its duly authorized representatives with the approval of the Department, while engaged in the construction of a state highway upon new alignment, may restrict the use of and regulate the movement of traffic upon any highway intersecting the project at or near the place of intersection whenever such work interferes with or endangers the safe movement of traffic through the work.

**7.03 Notification of Highway Closure, Lane Closure, Controlled Traffic, Chain Control or Incident of Significant Media Attention**

The District Office Dispatch Center or Traffic Management Center (TMC) should be advised immediately by telephone or radio, whenever there is a highway closure, emergency lane closures, controlled traffic, chain controls, or any incident of significant media attention. A highway is considered closed when all lanes of a divided highway, in any direction, are not passable, or when both lanes of an undivided two-lane highway are not passable. Highways are considered closed, even if traffic is moving on the shoulder or via a detour. The closure may be due to snow, slides, slip outs, floods, accidents or other causes. This information should be routed through channels, e.g., Maintenance Supervisor to Superintendent, to Region Manager, to Deputy District Director, Maintenance, and designated District Duty Officer. Levels of authority can be by-passed when not immediately available. The District Dispatch Office or TMC in turn, shall immediately advise the Headquarters Highway Communications Center by telephone, radio, teletype or fax. The same procedure shall be followed in reporting the opening of the highway that has previously been reported closed. The District Office Dispatch Center or TMC should also notify the appropriate CHP office of the closure and opening of highways.

Each month, all highway closures and reopenings shall be recorded on Form DH-M-C 83 and archived in the district office for a period of at least seven (7) years.

**7.03.1 Executive Reporting Procedures**

It shall be the responsibility of the designated District Duty Officer to be familiar with the latest Executive Reporting Guidelines. The Duty Officer or alternates are to report events, as noted in the guidelines, and other significant events they feel could have a major impact on Caltrans. Reports shall be directed to the Director, or to alternates listed on the weekly Duty Officer roster. Executive reporting shall not preclude regular reporting procedures covered in Section 7.03 above.

#### **7.04 Bomb Threat**

When a report is received that explosives or bombs have been placed on the highway system, and the situation indicates that either the traveling public or our employees are in jeopardy, immediate action is to be taken to reduce such exposure to a minimum.

The Joint Operational Policy Statement between Caltrans and the CHP specifies that “any decision to close a highway will rest with the first member of either Department to arrive on the scene.”

Reopening of the highway will be with the concurrence of both departments. Differences of opinion concerning closure or reopening will be resolved in favor of “maximum protection for the public.”

In order to insure the most rapid response to such threats, authority to take immediate action in closing a portion of the highway system is to be delegated to the lowest practical level. In Caltrans, this level will usually be defined as the field supervisor level. After taking action, the field supervisor will provide highway closure notification as indicated under Section 7.03 of this chapter. In addition, each district will develop procedures insuring prompt notification to the CHP of any actual or suspected incident involving an explosive device on a State highway or highway related structure. These procedures include the notification of any change in status of the affected highway or highway structure.

Bomb searches on State highways are the responsibility of the CHP under the Joint Operational Policy Statement. Districts, at their own discretion, may enter into a training program with CHP for selected employees in critical areas to aid in such searches. Selected employees should be volunteers and should be chosen because of specialized knowledge specifically needed to protect a vital segment of the highway system. Only those employees who need to participate will be allowed near a reported bomb area.

An area of concern to the CHP has been delays in obtaining specialized equipment needed during bomb searches. It is Caltrans' policy to cooperate fully in providing support and assistance to the CHP, as provided in the Joint Operational Policy Statement. All requests from CHP for needed equipment should be handled expeditiously. Each district shall take the initiative in contacting the local CHP office to formalize procedures to be used in ordering and supplying specialized equipment for bomb searches. Limitations on the use of equipment operators should be the same as for the selected employees mentioned above. In no case should untrained employees without adequate protective equipment be knowingly exposed to the hazards of an explosive device.

### **7.05 Emergency Detouring of Traffic**

Attention is directed to Chapter 6C of the MUTCD and the CA Supplement in section entitled “Detours and Diversions.” When a road has been closed and will remain closed for several hours or longer, and a detour route is available, such detours should be signed as soon as possible.

If the closure involves a road where non-motorized (bicycle/pedestrian) travel is permitted or a separate bicycle/pedestrian path, personnel responsible for designating the detour route should provide a detour which enables continuity for non-motorized modes.

When a road is closed and no detour is available, warning signs (illuminated at night), should be placed at the nearest towns or other convenient points to reduce unnecessary motorist travel and confusion. If conditions are recurring, the necessary signs, made up by competent workers, shall be kept on hand.

Where the closure affects a route or routes in other districts, the TMC of the affected district(s) must be advised at once so that the necessary detour signs may be placed. Headquarters Office of Structures Maintenance and Investigations should also be informed if the closure is caused by failure of a bridge.

The district office will notify the CHP and the local radio and television stations when local traffic is affected; and also notify the major networks when a main route is closed.

### **7.06 Flooded Traveled Way**

When the traveled way is flooded but passable, workers should place W55 (CA) FLOODED signs and delineators to mark the edge of the traveled way. Warning lights should be used whenever traffic would encounter some unusual or unexpected condition. Flaggers may be placed to slow down traffic if flooded condition presents a surprise element. Pilot car service may be provided when necessary. Close the road as soon as it is evident the water will become too deep for safe travel.

### **7.07 Supply of Signs, Etc.**

Each supervisor shall be equipped with sufficient signs, barricades and portable flashers to enable him/her to protect the public against emergencies which may arise in their particular territory. In locations where floods or storms may be expected to disrupt traffic, a routine check shall be made to assure the availability of signs, barricades and condition of detours at the beginning of each winter season.

Each district has been furnished with signs to be used exclusively for marking detours and road closures due to floods and high water. These emergency road closures, due to floods, usually occur at known locations.

Signs for these detours and closures should be properly maintained, and should be immediately available for this special use. They should not be used for any other purpose.

### **7.08 Disabled and Abandoned Vehicles**

The legal authority for Maintenance personnel to move unattended vehicles along or from a highway is quite limited. Sections 22654 (c) and (d) of the California Vehicle Code permit removal by State forces of any disabled or unattended vehicle to the nearest safe and legal parking location under the following conditions:

- (A) The vehicle is obstructing traffic.
- (B) The vehicle is obstructing work being performed on the highway. This reason is applicable to legally parked vehicles only if signs announcing the parking prohibition have been posted for at least 24 hours.

If the moved vehicle cannot be easily seen from its former parking location, it is required that the owner be notified without delay. If the owner is unavailable, and the location is within an incorporated city, the city police should be notified. If the location is not within an incorporated city, it is necessary to notify both the CHP and the Sheriff's Department.

If a disabled or unattended vehicle is not obstructing traffic or work on the highway, it may not be legally moved by Maintenance forces. Removal or moving must be accomplished by authorized law enforcement officers as described in Vehicle Code Sections 22652, 22654, and 22655.

Where the vehicle is clearly junk, is of no value, and has been in its abandoned location for a week or more (and the CHP refuses to see to its removal), it will then be in order for Caltrans Maintenance forces to haul it to the nearest available location for junking.

When a wrecked or broken down commercial vehicle is carrying livestock or perishable cargo, it is permissible to issue emergency permits to move on weekends or holidays, or after the usual hauling hours. Loaded butane tankers and other highly flammable or explosive cargos are in the same category.

When it is necessary to clear a highway following a wreck, any debris or wreckage which constitutes a hazard to traffic should be immediately removed from the traveled way by Maintenance. Promptly thereafter, the Regional Office should communicate with the party responsible for the accident to ascertain whether he/she wishes to remove any remaining debris from the highway, or whether State forces are to remove it at his/her expense.

In cases where death or serious injury results to any person, the damaged vehicle or vehicles should be left untouched and traffic protected by flaggers or barriers, lights, etc., until CHP has had an opportunity to examine the wreck. Otherwise, evidence which may be needed by CHP or by the District Attorney's Office for the prosecution of a criminal offense may be destroyed.

In all cases of serious accidents, the Maintenance personnel should cooperate with CHP and the District Attorney's office. State Maintenance personnel are not required to await the arrival of insurance company representatives on the scene of an accident before removing wrecked or damaged vehicles.

In the event a Maintenance employee is required to aid a motorist whose vehicle has become disabled, under no circumstances shall the employee accept payment for such assistance. Gratuities shall not be accepted from tow truck operators or anyone else who may be called to assist at the scene of an accident or other disability.

Such assistance should be made only when commercial operators or CHP officers are not available.

#### **7.09 Moving Injured Persons**

Maintenance personnel should use careful judgment in deciding whether to remove an injured person from the traveled way. It is preferable that this be done by or under the direction of a CHP officer, or paramedics. Factors to be considered include:

- (A) Evident nature of the injury and probability of increasing its severity.
- (B) Danger from traffic to the injured person or others.
- (C) Danger to traffic by obstructing the traveled way.
- (D) Estimated time of arrival of the CHP or an ambulance. (See Section 8.08 for instructions covering emergency first aid). If a CHP officer is not available, and it is not convenient to notify the sheriff's office, Maintenance personnel are authorized by Section 20016 of the Vehicle Code to arrange for an ambulance or some other conveyance to move the injured person to a hospital, if the injured person does not object to such transportation.

### **7.10 Deceased Persons**

Bodies of deceased persons are not to be moved by Caltrans employees unless the location of the bodies clearly causes a significant danger to traffic or personnel. If the CHP cannot be located, information should be sent to the sheriff or coroner, who will arrange for removal of the bodies.

### **7.11 Warning Traffic**

When a slide, slipout or other incident occurs which partially or wholly blocks the traveled way, appropriate signs should be placed at each side of the location, and on the right of approaching traffic 400 to 800 feet in advance of the obstruction. That portion of the road which is obstructed shall be blocked off with barricades. At night, warning lights should be placed on both signs and barricades, and a sufficient number set out along the road to outline the obstruction. This same procedure should be followed for road repair work which is not completed in one day.

- (A) On roads carrying heavy traffic, one or more flaggers should be assigned, depending on length of control and sight distance.
- (B) The C9A (CA) Flagger Ahead symbol sign should be placed in advance of all flagger stations. The distance between the sign and the flagger should be based on the average traffic speed, allowing approximately 100 feet for each 10 miles per hour.
- (C) Where the number of vehicles to be controlled are such that one flagger cannot handle the control and contact the last vehicle in line, a second sign shall be placed, and a second flagger assigned.
- (D) Signs should be well lighted or retroreflectorized for night work.
- (E) When flaggers are required, they should be logically placed in relation to the equipment or operation so as to give adequate warning.
- (F) At the flagging station, if barricades are not required on the traveled way, they should be placed in position on the shoulder or otherwise to indicate the control point.
- (G) All signs, barricades, and other equipment should be maintained in good condition.

Both the district office and Headquarters should be notified in advance when a traffic control is to be established for an extended period of time. When the control is discontinued, signs and barricades should be removed immediately, and the district office, as well as Headquarters, notified of the discontinuance.

Note: Barricades should not be used to channelize traffic.

### **7.12     Flagging Traffic**

Attention is directed to Standard Plan T-13 and Chapter 6E Flagger Control of the MUTCD and the CA Supplement. Flagging of traffic should be handled in a uniform manner. Flaggers should be alert, intelligent and agile, have good hearing, and be capable of favorably impressing the traveling public, as well as securing their cooperation.

In addition to other required personal safety gear, all persons assigned as flaggers shall wear orange, strong yellow-green, or fluorescent versions of these colored warning garments such as vests, jackets, shirts or other approved orange warning garment. An adequate stock of orange jackets, shirts, or vests shall be kept available for the use of flaggers as required. Jackets or vests should be kept clean and in good condition. Raingear, when worn, shall be orange, strong yellow-green, or yellow.

A flagger shall not engage in argument with a driver or a passenger. If a driver refuses to obey a flagger's instructions, a record is to be taken of the license number of the car and the time of day, and a report made to the flagger's supervisor.

Refer to Chapter 6E of the MUTCD and the CA Supplement in section entitled "Flagger Procedures" for proper signaling devices and procedures.

### **7.13     Markers and Communications Controls**

When the traffic control is relatively short, but flaggers are not in position to visually signal each other, the control is governed by a red flag or other token given to the driver of the last vehicle released. The flagger then holds traffic until the flag is returned to him/her by the last driver in the line from the opposite direction.

### **7.14     Pilot Car or Vehicle**

When the control is long, and it is desired to keep traffic in line or at reduced speed, as during oiling work, a pilot car should be provided in addition to the flaggers to direct traffic through the work zone.

### **7.15 Time Control**

When a control is necessary over a narrow section of highway for an extended period, the District Director may recommend a time control. Local newspapers, radio and television stations, also other interested agencies, shall be notified of the time the road is to be closed and opened to traffic. The control is handled by flaggers supplemented by signs and publicity as to conditions.

### **7.16 Barricades**

Attention is directed to Standard Plan A73C and Chapter 6F of the MUTCD and the CA Supplement in section entitled "Type I, II, or III Barricades." Barricades are intended for use after traffic has been diverted from a roadway. Traffic should be diverted by the use of cones, channelizers, delineators, pavement markers, and signs, used in appropriate combinations. Type III barricades may then be used as a final closure, a positive barrier to traffic.

Type III barricades should not be used adjacent to traffic in lieu of guard rail or temporary "K" rail (concrete barrier).

Type II barricades and the portable flasher support are small and light and may be easily handled and carried about. They are invaluable in maintenance operations for the protection of pavement patches, to warn traffic of damaged pavement and openings in the traveled way, and used with traffic cones in forming a transition to protect workers on the traveled way.

### **7.17 Supplemental Signing**

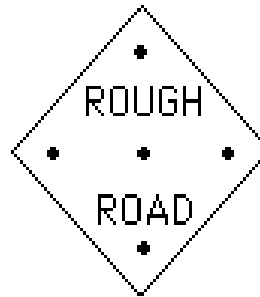
The following signs may be used within an area closed to traffic after traffic has been directed around the work:

The W8-4 SOFT SHOULDER signs may be used on sections where the constructed or natural stability of the shoulder has been destroyed or impaired by maintenance or construction operations, such as in grading or spreading new material over the old. Retroreflectorized signs should be used on main traveled routes with unstable shoulders. Where the length of the soft shoulders is extensive, retroreflectorized signs should be placed at about one (1) mile intervals.

The R11-2 ROAD CLOSED is to be placed on a barricade at the point of road closure, supplemented by one or two Type N markers.

### 7.18      **Rough Road**

This W8-8 ROUGH ROAD sign should be placed in advance of rough pavements as required. The road condition should be corrected as soon as possible.



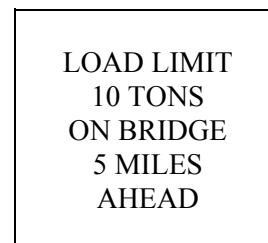
**Code W8-8**

### 7.19      **Restricting Loads on Bridges**

**Temporary Signs.** When an emergency develops due to an accident or failure of a structure member, or when, after an investigation, it appears a structure is not capable of carrying full legal loads, temporary signs shall be placed immediately. The temporary signs are to notify traffic of the load limit, pending repair of the bridge or holding of a hearing and obtaining permanent signs. Districts should obtain a small supply of temporary signs, with blank space for filling in the weight or speed restrictions, so that they will be immediately available when required. Temporary signs may be secured from the Service and Supply warehouses.

**Permanent Signs.** The R12-5 Weight Limit and R21(CA) Bridge Speed signs, with limits as recommended by the Bridge Engineer, shall be erected to replace such temporary signs if the bridge cannot be repaired or strengthened within a reasonable time. Ordering of such signs need not wait upon the formal posting order. These signs shall be placed not more than 500 feet from each end of the bridge or structure.

Where a detour is not available at the site of a posted bridge and trucks would have no opportunity to turn around and retrace their path, advance signs shall be erected to notify truck drivers of the restriction, thus affording them the opportunity of selecting another route. The following is a suggested wording for such advance signs:



## **7.20 Restricting Loads on Highways**

When, as provided in Section 35751 of the California Vehicle Code, a weight limit is declared on a State highway, standard signs shall be erected at each end of the portion of highway affected and at such other points as are deemed necessary to give adequate notice of such weight limitations.

## **7.21 Storage of Explosives**

Attention is directed to Chapter 6F of the MUTCD and the CA Supplement in sections entitled "Signs for Blasting Areas, BLASTING ZONE AHEAD Sign, TURN-OFF 2-WAY RADIO AND CELL PHONE, and END BLASTING ZONE."

The following signs have been standardized for use in the handling, and storage of explosives:

This sign shall be placed upon the premises on which powder magazines are located. It shall be placed within 100 feet of the magazine, and so placed that a bullet through the sign will not strike the magazine.



**EXPLOSIVES  
KEEP OFF**

54" X 36"  
8" Red Letters on  
White Background

Signs with this wording shall be placed on each side of blasting operations by the flaggers to stop traffic. The signs shall be removed or turned away from traffic when it is safe to proceed.



**BLASTING  
AHEAD  
STOP AT  
FLAGGER**

30" X 24"  
4" Red Letters on  
White  
Background

## **7.22 State Property**

The S1-1(CA) STATE PROPERTY sign is to be used at stockpiles, isolated buildings, etc., to identify State property.

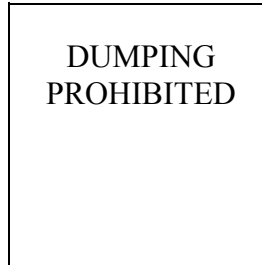


**STATE  
PROPERTY**

21" X 15"  
Embossed Black  
Letters on Yellow  
Background

### 7.23 Dumping Prohibited

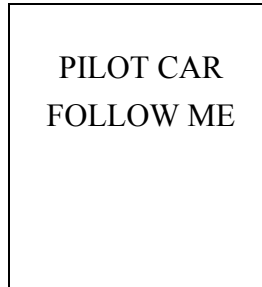
The SR22-1(CA) DUMPING PROHIBITED sign is not to be used on State highways where it is visible to traffic. It may be used at borrow pits or other locations where the message is required. The R47(CA) \$1,000 FINE FOR LITTERING sign shall be used exclusively to convey this message to traffic on the State highways.



32" X 14"  
4" Red Letters on  
White  
Background

### 7.24 Pilot Car Service

Attention is directed to Chapter 6F of the MUTCD and the CA Supplement in section entitled "PILOT CAR FOLLOW ME."



C 26  
36" X 18"  
5" Black Letters  
and Border on  
Orange  
Background

### 7.25 Traffic Controls in Snow Areas

- (A) **Speed Regulations.** Attention is directed to Chapter 2B of the MUTCD and the CA Supplement in section entitled "Speed Limit Sign (R2-1)." Section 22363 of the California Vehicle Code authorizes Caltrans to erect appropriate speed limit signs for prima facie speeds of 40 miles, 35 miles, 30 miles or 25 miles per hour when, by reason of snow or ice conditions, such speeds are most reasonable or safe. The R2-1 Speed Limit sign should be used when required. Such speed limit signs may be placed and removed as snow and ice conditions vary. The only sign to be used to regulate speed in the snow areas is the R2-1 Speed Limit sign. It has been the practice to install R2-1 Speed Limit signs in the vicinity of resorts, ski tows, and at other critical locations where skiers and children frequently cross the highway. These speed limits should be established by District Traffic Operations.

- (B) **Parking Regulations.** Attention is directed to Chapter 2B of the MUTCD and the CA Supplement in section entitled “Parking, Standing, and Stopping Signs (R7 and R8 Series).” Section 22510 of the Vehicle Code authorizes Caltrans to prohibit parking on either or both sides of a highway which has been cleared of snow, but where the width of the highway is still restricted. The R26(CA) and R28(CA) NO PARKING ANY TIME signs are used to indicate the areas where parking is prohibited. Within those areas where parking is permitted, it is customary to install R25(CA) PARK OFF PAVEMENT signs at frequent intervals.
- (C) **Chain Control.** Attention is directed to Chapter 2B of the MUTCD and the CA Supplement in section entitled “Chain Control Signs (CA Codes R74, R75, R76, R76-1, R77, R78, R79 and R80-1).” Most districts have certain areas that are subject to annual snowfall. It is good practice to install the SW58(CA) WATCH FOR SNOW REMOVAL EQUIPMENT signs in black letters on yellow, on all highways leading to snow areas. These signs are generally placed at the lower elevations where the first snow is usually encountered. They should either be hooded or removed during the summer season.

Chain control areas are marked with R76(CA) CHAINS REQUIRED ONE MILE AHEAD signs, R75(CA) CHAINS REQUIRED, and R78(CA) END OF CHAIN CONTROL. Within the chain control area, Caltrans may permit, as an alternate, the use of snow tread tires on authorized vehicles. Standard chain signs should be in place on each side of built up areas that develop an appreciable volume of traffic. Permanent installations should be made to facilitate putting the chain signs into service by Maintenance personnel.

Permits to individuals, who must apply in person, for installing tire chains on highway right of way may be issued. Contact District Encroachment Permit Engineer for assistance.

Certain highways are allowed to close each winter due to heavy snow. At the beginning of these areas, signs reading “SNOW NOT REMOVED BEYOND THIS POINT--PROCEED AT YOUR OWN RISK” should be installed. Arrangements shall also be made to place signs prominently at important intersections and other advance points to inform traffic when a through route is closed by snow. Such a sign should read “\_\_\_\_\_CLOSED BY SNOW BEYOND\_\_\_\_\_.”

### **7.27      Warning Signs for Snow Areas**

Note : The typical arrangement of signs required in snow areas is under revision, and will be available at a later date. Contact your District Traffic Office for direction.

Other useful signs are:

This sign may be used for general information, especially when permanent snow signs are not used.

CHAINS  
MAY BE  
REQUIRED  
AT ANY TIME

60" X 28"  
Black Letters  
on White  
Background

SR20-1(CA) SNOW NOT REMOVED BEYOND HERE – This sign should be erected at the beginning of the snow season and removed in the spring when the road is opened.

SNOW NOT  
REMOVED  
BEYOND HERE

48" X 30"

Signs with this or similar wording shall be placed at important intersections leading to those routes that are closed for the winter by snow. Quite frequently, several signs will be required for this purpose. The signs shall be permanently installed, with the word "Open" placed on the sign face. The words "Closed by Snow" and "Beyond Pinecrest" shall be on detachable plates, which may be removed or changed as conditions require. The plates should be removed as soon as the road is opened.

SONORA PASS  
CLOSED BY SNOW  
BEYOND  
PINECREST

Retroreflectorized  
(size variable)  
White Letters on  
Black Background

**TYPICAL SIGNING FOR SNOW AREAS**

This page is under revision, and will be distributed at a later date. Contact your District Traffic Office for direction.

# **CHAPTER 8**

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## **8.00 Introduction**

It is Caltrans policy to conduct its business in the safest possible manner consistent with applicable law, policy, or rule.

This chapter of the Caltrans Maintenance Manual is a part of the Caltrans written Injury and Illness Prevention Program (IIPP). It provides detailed instructions for managers, supervisors, and employees. It is designed to help employees in their efforts to work safely. All employees are expected to follow these minimum guidelines.

Other employee safety subjects are covered in other chapters of this manual, the Maintenance Code of Safe Operating Practices, and in the Caltrans Safety Manual.

The most important part of our job is to protect ourselves from traffic, while getting our work done. We do this by:

- (A) Letting the motorist know what's going on and where to drive.

For this we use signs, flags, barricades, cones, flashing amber lights, portable changeable message signs (PCMS) and flashing arrow signs (FAS).

- (B) Avoiding the errant driver.

Face traffic, stay aware through your own eyes and ears or those of a lookout who will warn you. Plan your escape route.

- (C) Using protective equipment.

Protective vehicles, headrests, seat belts/shoulder harnesses, and personal protective equipment as described in the Caltrans Safety Manual, Chapter 12.

- (D) Planning the work to reduce employee exposure to traffic.

## **8.01 Managers and Supervisors Responsibilities**

The following paragraphs summarize the basic elements of the Caltrans Injury and Illness Prevention Program and define who is responsible for enforcing the safety and health policies

and practices. For further information, consult Chapter 1, of the Caltrans Injury and Illness Prevention Program, in the Caltrans Safety Manual.

- (A) Supervisors and managers are the responsible persons to implement, maintain, and enforce Caltrans safety rules and policies.
- (B) Supervisors, in cooperation with training personnel, shall ensure that all employees receive safety related training to include:
  - (1) General training to cover hazards basic to all places of employment.
  - (2) Specific training to cover hazards that are unique to each employee's job assignment.
- (C) Supervisors shall ensure that each employee is able to understand how to complete each assigned task safely.
- (D) Supervisors shall ensure that each employee follows safe and healthy work practices and procedures, and shall initiate corrective action for non-compliance.
- (E) Supervisors shall keep abreast of safety and health regulations affecting the operations they supervise.
- (F) Supervisors shall ensure that each employee is provided with the equipment necessary to complete assigned tasks safely.

Supervisors or managers who observe an employee that appears to be unable to perform his/her assigned duties and have a concern about the safety of the employee or others, are responsible to prohibit that employee from continuing to work. The employee should be prohibited from working until a determination of the reason for the employee's behavior is made, or until a medical evaluation of the employee's fitness can be completed.

Any supervisor or manager who fails to enforce safety and health policies, procedures, regulations, laws, or rules shall be disciplined in accordance with the provisions described in the Guide to Employee Conduct and Discipline (Department of Personnel Administration).

Supervisors and managers shall ensure that employee safety and health issues are discussed and assessed with employees at least annually at the time of issuing an Individual Development Plan/Performance and Appraisal Summary, and/or at the time supervisors discuss employee probationary reports.

Supervisors in office work settings should include discussions about health and safety matters at routinely scheduled staff meetings, but at a minimum, shall have meetings with their employees at least quarterly to discuss safety and health issues.

Supervisors in field locations shall have tailgate safety meetings at least every ten (10) working days to be in compliance with the requirements of the Construction Safety Orders, CCR1509 (e), or when starting new work activity to comply with Code of Safe Operating Practices.

Supervisors shall also conduct pre-job/post-job meetings with employees whenever a new process, chemical, or procedure is introduced that contains a new or previously unrecognized hazard, or when a new or previously unrecognized hazard is identified.

Supervisors shall provide initial safety orientation to new employees including, but not limited to, the specific hazards of the job, required personal protective equipment, Chapter 8, and the Code of Safety Operating Practices.

## **8.02 Individual Responsibilities**

Employees shall do everything reasonably necessary to protect their own safety and health and that of others by complying with all safety and health policies, procedures, laws, rules, or regulations. Employees shall report all injuries, illnesses, or unsafe conditions to their supervisor immediately or at least by the end of the work shift.

Employees are expected to report to work mentally and physically capable of performing all of their assigned duties without jeopardizing the safety and health of themselves, other employees, or the public. Employees shall be free from the effects of medication, controlled substances, alcohol, or the complications arising from illness or injury, which might impair their judgment and/or ability to perform their work.

Employees are responsible to notify their supervisor of any personal medical condition or prescribed medication use that might impair their ability to perform their assigned duties. Employees should also report to their supervisor any behavior by another employee that reasonably indicates that they are not fit for duty.

Any employee who violates any safety and health policy, procedure, regulation, law, or rule will be disciplined in accordance with the provisions described in the Guide to Employee Conduct and Discipline (Department of Personnel Administration).

## **8.03 Responsible Person In Charge**

It is practice and policy that whenever two (2) or more employees are assigned to work together, one of the employees shall be placed in charge.

This responsibility is usually assigned to the designated supervisor or leadworker based upon his/her civil service classification. However, there may be occasions when these individuals are unavailable to direct the work for given periods of time, or where emergencies arise that require non-supervisory employees to direct the work of others.

Supervisors must always designate an individual to be in charge during any work assignment or absence, and identify the steps to be taken in the event of an emergency.

#### **8.04 Work Site Safety**

Managers and supervisors are responsible to:

- (A) Routinely inspect all field and facility work areas under their jurisdiction to identify, document, and eliminate hazards that may contribute to injuries or illnesses. In order to accomplish this, Region Managers should do three (3) or more safety reviews per month, and Area Superintendents should do three (3) or more field or facility safety reviews per week. Supervisors should be routinely inspecting work sites and work areas and documenting/correcting any deficiencies.
- (B) Ensure that employees are properly trained and equipped to do the job, and that they understand how to do it properly.
- (C) Investigate every injury or illness and vehicle accident to: (For further information, refer to the Caltrans Safety Manual, Chapter 4).
  - (1) Determine contributing circumstances, and
  - (2) Develop information that leads to correcting unsafe conditions and unsafe acts.
- (D) Establish and maintain codes of safe operating practices, or equivalent, which identify hazards specific to job assignments.
- (E) Enforce all rules, laws, and policies that will promote, protect, and preserve employee safety and health.

#### **8.05 Changing Chapter Standards**

Chapter 8 requirements are intended for the usual situations. Unusual circumstances may call for greater or lesser protective measures than are described here as standard. It is not possible, or even desirable, that a manual such as this contain detailed rules for every possible situation. It is

up to the supervisor to exercise judgment in applying these measures. Supervisors should not, through the use of protective devices, create greater hazard to their crews by increasing the severity and/or duration of exposure. They should consider all factors, particularly the safety of their employees, when applying the requirements of this chapter.

Deviations from standard measures may be judged desirable by the supervisor for a variety of reasons such as sight distance, proximity of ramps or street intersection, restrictive width, short duration of job at one location, or minimal exposure because of volume, speed, and proximity of traffic. **Decisions to reduce standard measures must have the written approval of someone responsible for the work at the Area Superintendent level or higher.** This written approval shall describe the deviation and list the reason(s) it is needed. It shall be kept on file in the region office for three (3) years. This written approval is not needed in situations which develop suddenly and unexpectedly and demand immediate action to prevent injury or harm to workers or the traveling public. Operations should be brought up to standard as soon as resources become available. The supervisor may increase worker protection using standard devices without approval.

The standard lane closure plans, Standard Plan T10 through T17, are for normal work zones and conditions. In unusual situations, the Maintenance Engineer may request District Traffic Operations to authorize a deviation at a specific location, providing:

- (A) The specific location is identified by county, route, and postmile.
- (B) The deviation does not compromise the safety of workers.
- (C) The deviation is not for general use throughout the district.
- (D) The deviation and rationale are documented in district files.

The intent is to allow deviation at specific locations without creating individual district wide standard plans. A deviation could be allowed for an indefinite time at a specific location, if the special conditions remain unchanged.

In 2004, Caltrans adopted the Manual of Uniform Traffic Control Devices (MUTCD) as amended by the MUTCD California Supplement (CA Supplement). Part 6 of each manual establishes standards for traffic controls in highway construction and maintenance work zones. The MUTCD is published by the Federal Highway Administration (FHWA), while the CA Supplement is published by the Division of Traffic Operations. In case of any inconsistency between the MUTCD and Chapter 8 of Maintenance Manual, Volume One, Maintenance forces are to follow Chapter 8 since, in certain instances, Chapter 8 requires more stringent measures. Signs referenced with (CA) in this chapter indicate a California sign code. Otherwise, the sign code referenced is a Federal sign code.

### **8.07      Personal Protective Equipment**

Caltrans provides the personal protective equipment (PPE) employees will need to work safely. This equipment is for worker protection and they shall use it properly to prevent injuries/illnesses.

Personal protective equipment consists of many items. Hard hats, orange or yellow-green shirts, safety vests, safety glasses, earplugs or muffs, gloves, goggles, respirators, raingear, and foot protectors are some examples.

The supervisor should select and provide the proper equipment and ensure workers wear it.

Refer to Appendix C of the Code of Safe Operating Practices and Chapter 12 of the Caltrans Safety Manual for more information about personal protective equipment. Refer to Chapter 15 of the Caltrans Safety Manual for the requirements when using respiratory protection.

### **8.08      Emergency First Aid**

All Maintenance employees should be trained in Standard First Aid during the first three (3) months of their assignment, and at least once every three (3) years thereafter. All Tree Maintenance Workers and related classifications, and all designated Electrical personnel shall be trained in Cardio Pulmonary Resuscitation (CPR) during the first month of their assignment, and then at least once a year thereafter. The training must be certified by the American Red Cross or other accredited organization.

An approved first aid kit shall be available at each work site. First aid kits and supplies shall be kept in sanitary and usable condition and inspected at least monthly. The Caltrans Safety Manual, Section 9.09 and 9.10, specifies size, location, and quantity of supplies for various categories of first aid kits.

For more information on first aid and emergency medical care see Chapter 9 of the Caltrans Safety Manual.

### **8.09 Medical Treatment**

Supervisors are responsible to ensure that if an injured or ill employee needs medical attention he/she will be taken to the nearest approved medical clinic or hospital emergency room for treatment. Supervisors shall post the name and location of each approved medical service provider in a conspicuous place at each Caltrans work site. At a minimum, they shall be posted on designated bulletin boards in hallways or individual offices, and other appropriate locations, such as motor vehicles, to ensure every employee is aware of the locations. A list of approved medical service providers is also available at the Caltrans Intranet, Administration, Health and Safety Information web site.

If the injury is serious, an ambulance should be called.

A supervisor or designee shall always accompany the injured or ill employee to the medical facility.

As conditions warrant, the supervisor should talk with the attending physician to determine the extent of the injuries, the affected employee's recovery period, ability to return to work, and the employee's ability to perform the full range of duties upon release.

The supervisor must describe to the doctor what modified duty is available so that the employee can return to work as soon as possible.

Employees shall report any work-related injury to their supervisor immediately, or at least before the end of the work shift. They shall also report the injury to the supervisor before going to a doctor.

For more information on reporting personal injury accidents and illnesses see Chapter 10 of the Caltrans Safety Manual.

### **8.10 Definitions**

Moving Operations	A moving operation is any work activity that moves along the traveled way or shoulder slower than the prevailing speed of traffic. Moving operations may also involve short and/or periodic stops. On-foot exposure (for example, to remove a large piece of debris in front of a sweeper) must be held to a minimum and physical protection from traffic is required. Some examples are striping, sweeping, spraying, raised pavement marker replacement, etc.
Short Duration Operation	In general it can be defined as any activity that can be performed in 20 minutes or less during light traffic volumes, without interfering with traffic or placing the employee in jeopardy. Short duration activities are those in which it takes longer to set up and remove the traffic control zone than to perform the work. Some examples are pothole patching, removing a large piece of debris, etc. A protective vehicle or lookout must be used.
Stationary Operation	A stationary operation is any work activity that includes workers on foot or equipment occupying any part of a paved shoulder or the traveled way at one location for more than 20 minutes.

### **8.11 Protective Vehicles**

There are three (3) classes of protective vehicles: Shadow, Barrier, and Advance Warning.

#### **(A) Shadow Vehicle**

A shadow vehicle is used to protect the work vehicle in a moving operation. A shadow vehicle shall:

- (1) Have a truck mounted attenuator (TMA) which softens the blow to our driver, and usually reduces the impact to the motorist. It does not reduce the distance a vehicle will roll ahead when hit.
- (2) Must be equipped with Type II FAS.
- (3) Be equipped with headrests or high back seats.
- (4) Be equipped with seat belts and shoulder harnesses.
- (5) Be equipped with a two-way radio.

The shadow vehicle's headrest/high back seat protects the driver's head and neck. The seat belt and shoulder harness prevent the driver from being thrown forward. Normally, the shadow vehicle shall be occupied by the driver only. However, if a passenger must occupy the vehicle while it is shadowing, the passenger seat shall also be equipped with headrests or high back seats and a seat belt and shoulder harness.

The purpose of a shadow vehicle is to provide physical protection for crews and their vehicles. The mass of the shadow vehicle is the most important factor in providing protection. The heavier the shadow vehicle, the better the protection that is provided.

The shadow vehicle shall be positioned upstream from the work vehicle between approaching traffic and the vehicle it is protecting. It should be positioned where it will provide the best protection; not too close, or not too far back. It must be positioned a sufficient distance in front (upstream) of the workers or equipment being protected to allow for appropriate vehicle roll-ahead, but not so far that errant vehicles will travel around the vehicle and strike the workers/equipment.

When making the decision as to how to position the shadow vehicle, you must use your best judgement. Because every situation will be different, you should take into consideration the following factors:

- Volume and speed of traffic—
  - With higher speeds comes the potential for increased roll ahead if struck
  - Will traffic volume affect the level of protection needed?
- Physical configuration of the roadway itself—
  - Curves vs. straight sections
  - Hills or dips that impair forward vision
  - Super elevation of curves
  - Width of improved/unimproved shoulders
- Sight distance—
  - How much sight distance is available?
- Weather and pavement conditions—
  - Dry, wet, icy
  - Rough pavement

Discuss the above factors with your work crew prior to going out on the road. Maintain two-way radio contact with the work vehicle so that movements are coordinated.

**(B) Barrier Vehicle:**

A barrier vehicle is an unoccupied vehicle or piece of equipment used to protect workers from errant motorists. Any vehicle at a work site can be used as a barrier. However, workers shall use the heaviest vehicle reasonably available. In certain instances, more than one (1) barrier vehicle may be needed. A barrier vehicle does not require a TMA. However, if a TMA is available, it should be used.

Any vehicle that is used should be parked upstream from the work site between approaching traffic and the workers. It should be parked where it will provide the best protection; not too close to the workers, not too far back. It shall be carefully positioned so that it will intercept errant vehicles, but will not roll ahead into the work area. Always park the barrier vehicle with the emergency brake set and lower any attachments to the ground.

A barrier vehicle without a TMA can be parked a number of ways. It can be parked at an angle or even straight across the lane. If it is parked at an angle, the front of the vehicle should be pointed away from traffic. The wheels shall be turned away from the work zone and away from traffic, if possible. This will avoid motorist panic and prevent secondary collisions if the barrier vehicle is hit and pushed ahead. A barrier vehicle with a TMA should normally be parked parallel with the direction of traffic.

**(C) Advance Warning Vehicle:**

An advance warning vehicle is driven or placed upstream from a work zone (refer to the Moving Lane Closure Plans T15, T16 or T17). It alerts the approaching motorists of work being performed on or near the travel way.

On the shoulder of a two-lane highway, it shall display either a FAS in the caution mode, or a flashing amber light/rotating light. On the shoulder of a multilane highway, a FAS with the "Flashing Arrow" displayed shall be used if the work vehicle is on the traveled way. A changeable message sign may also be used.

If the vehicle encroaches into the traveled way, it shall be equipped as a shadow vehicle and operated in accordance with the guidelines in Section 8.11. If it encroaches into a freeway lane, the vehicle shall display a FAS in the arrow mode. If it encroaches into a two-way conventional highway, the FAS shall be in the caution mode, or display a flashing or rotating amber light.

**8.12 MAZEPP (MAintenance Zone Enhanced Enforcement Program)**

Caltrans coordinates with CHP to utilize officers on site at highway maintenance projects. MAZEED is used to reduce the potential for traffic collisions, reduce traffic speeds to the posted speed limits, and to increase safety of the workers and motorists.

**(A) RESPONSIBILITIES**

- **Maintenance Area Superintendent** - or his/her designee, should make an assessment of the need for MAZEED on projects that require the closure of traffic lanes with either cones or moving vehicles. The Superintendent may also identify specific Maintenance operations where the use of MAZEED may be required.
- **Maintenance Supervisor** - is responsible to request MAZEED services according to the interagency contract, and to provide clear and concise instruction/direction as to what duties the officer will perform and placement of CHP vehicle. These instructions will include worker and motorist safety concerns, traffic control procedures, and any anticipated traffic delays. This direction will be given prior to entering the work zone or at pre-job meeting.

Working in conjunction with the CHP, supervisors should discuss a contingency plan to be placed in effect should traffic delays beyond reasonable limits occur.

Supervisors are responsible for discussing, arranging, and/or providing communications with on-site officers. This may include hand-held radios, cellular phones, or the use of multi-agency scanners set to the appropriate frequencies.

Supervisors will work cooperatively with on-site officers to mitigate traffic delays caused by maintenance operations. Decisions to abate or discontinue work for traffic considerations shall be made collaboratively. Considerations shall be given to the type of work being performed, length of time until probable completion, and potential/probable exposure to personnel and additional traffic delays caused by resetting the traffic control system and reopening the work zone.

If the supervisor has made a timely request, and MAZEED service is not available, the supervisor may use alternate methods to enable the work to proceed. Alternate methods may include additional advance warning signs/vehicles, changeable message signs, lookouts, and/or additional protective vehicles.

**(B) UTILIZING MAZEED ON FREEWAYS AND HIGHWAYS**

**Shall** be requested for:

- All planned daytime or nighttime temporary closures of **ALL** lanes in the same direction of travel (full freeway closures).
- Planned night closures of two (2) or more lanes on a freeway with three (3) or more lanes of travel in the same direction.

**Should** be requested for:

- Any location/project that exposes workers on foot to moving traffic where escape routes are limited by median barriers, bridge rails, or similar structures and where additional physical protection is not deemed adequate.

**May** be requested for:

- Daytime closures of one (1) or more lanes on a full freeway or expressway
- Mobile work, e.g.; sweeping, striping, replacing pavement markers, etc.
- All other night work as deemed necessary by the supervisor.

**(C) DETERMINING WHEN TO USE MAZEPP**

Risk factors should be taken into consideration when determining when MAZEPP will be appropriate. Safety reviews conducted by the Superintendent and supervisor prior to the project (in the planning stages) may identify additional risks; if so, these risks must be considered in the decision making process. Some of these additional risk factors may include:

- Night maintenance activities that do not create an obvious work zone, such as replacing raised pavement markers or night sweeping operations.
- Maintenance activities that require a large number of vehicles or haul truck movements in and out of the work zone.
- Anticipated traffic queues that cannot be avoided.
- Working in locations where traffic has been flowing at high speed, free flow conditions for a significant period of time prior to the work zone (assistance may be required to reduce traffic speeds).
- Routes with high volumes of truck traffic and/or steep down grades.

When making the determination to use MAZEPP, be aware that overuse when conditions do not warrant may lessen its effectiveness in the future.

**8.13 Planning Work To Reduce Worker Exposure**

Supervisors shall plan work to minimize the amount of time employees are exposed to moving traffic. This can be done by choosing proper work methods, combining operations, avoiding high traffic volume periods, and utilizing MAZEPP (Maintenance Zone Enhanced Enforcement Program) and/or other devices designed to increase motorists awareness of the work zone.

Work methods and procedures should be designed to keep the amount of time workers are exposed to moving traffic to a minimum. For example, crews should be instructed to assemble in safe areas well away from the traveled way, convoy to the work site, and do their work expeditiously. Once work is completed, they should return immediately to a safe area.

In addition, when employees reach the work site, the work method should be designed to minimize the amount of time workers spend on foot near moving traffic. The first choice should be to use mobile power equipment to do the work. A worker in a piece of equipment is generally much safer than a worker on foot. The next choice of work methods would be to provide workers on foot with physical protection. For example, a barrier vehicle, guardrail, or some other obstacle can be used to provide physical protection. The last choice is to have workers on foot without physical protection. In this situation, the work method should be designed so that workers can face traffic whenever possible and can work apart as individuals and not in groups. If none of the above methods are possible, it may be necessary to have lookouts or a lookout alarm device or both. See Warning Systems - Lookouts, Section 8.17.

When a lane closure is planned, especially on freeways, managers and supervisors should contact all crews who could work within the closure. Good communication is a **MUST** in this situation. For example, along with roadway repair, stencil work, guardrail repair, electrical work, sign work, shoulder repair, sweeping, and landscaping can be completed. Not only will more work be completed, but also more protective vehicles may be available at the work site, providing workers with increased protection. In addition to Maintenance operations, managers should coordinate with District Traffic Operations, Surveys, and other district units for work needs within the closed lane. This approach will reduce employee exposure to traffic and the number of lane closures required for routine maintenance.

When planning combined operations, managers and supervisors shall also plan the work so that each employee has enough space to work safely. Refer to Crowding of Workers, Section 8.16.

Another opportunity to reduce worker exposure to moving traffic is to carefully plan work on the highway. When there are fewer vehicles on the traveled way, there are fewer vehicles with an opportunity to hit workers.

Managers and supervisors should consider reducing employee exposure by requiring an unconventional workweek or extended and/or multiple work shifts to take advantage of lower

traffic volumes. Managers should also review maintenance projects for opportunities to improve worker safety with a complete facility closure.

Before short-term tasks are assigned, the supervisor will determine if the task has to be done immediately, or if it could wait. He/she shall decide if it could wait until formal traffic control will be set up, and the job performed as a part of a combined operation. An example would be the removal of litter from a median area. If the debris is not a safety hazard, could picking it up wait until a lane closure is set for another reason?

Supervisors shall plan all work operations to minimize the need for the backing of equipment and vehicles at the work site.

Although it is not mandatory, supervisors should conduct a post-job meeting with the crew and discuss what went right during the most recent operation, what went wrong, and how as a team we could improve our work practices in the future.

#### **8.14 Working Near Moving Traffic**

When working on or near the traveled way for any amount of time, workers must be aware of the hazards from errant vehicles. If available, a vehicle, regardless of its size, shall be used as physical protection from traffic. Workers on foot shall face traffic whenever possible. Always be aware of potential protective barriers such as guardrails, trees, or other natural obstacles that could be used to shield you from errant vehicles. If physical protection is not available, a lookout may be necessary (Refer to Warning Systems - Lookouts, Section 8.17).

Working on the shoulder of a highway requires the utmost caution and awareness. Employees have been killed or seriously injured being struck by errant vehicles leaving the traveled way. It is every employee's responsibility to be aware and watchful while performing work on the shoulder of any highway.

While working on the shoulder, it is imperative that you keep a vehicle or other means of physical protection between yourself and approaching motorists. Keep to an absolute minimum the time you stand or work at the rear of your vehicle.

While working or retrieving debris near or within a gore point, you must be keenly aware of the dangers traffic poses while entering and exiting the highway. The gore areas are decision points where motorists are normally paying attention to the task of either exiting the highway or merging with traffic.

Hazards exist primarily at two specific points; at the off ramp gore itself and on the right side of the on ramp gore point where motorists are usually looking over their shoulder or in the rear view mirror, not necessarily looking forward while preparing to merge with traffic.

For stationary operations in gore areas, ramp closures and barrier vehicles should be placed to ensure worker safety in addition to required lane or shoulder closures on the through lane. On and off ramps should be closed per Plate T-14 in Chapter 8. Barrier vehicles shall be parked across the ramp(s) to prevent traffic from going around the cones and signs. Special instances may require a deviation. If a deviation is required, please see Section 8.05 Changing Chapter Standards.

If you must work in a gore area for a short duration task, you shall have a barrier or shadow vehicle equipped with a truck mounted crash cushion and have a lookout. For short duration tasks, it is recommended that you close the ramps and call for a California Highway Patrol traffic break before performing the work. Use your vehicle to protect yourself from oncoming from traffic.

Traffic on two lane conventional highways is often lighter than on freeways. Workers cannot let this fact lull them into a false sense of security.

When working on conventional two lane roads, employees shall be aware that errant vehicles can enter the work area from either direction. Many two-lane operations involve short duration work such as fixing guide markers, straightening signs, and litter removal. These operations involve workers on foot, often next to the traveled way. In these situations, employees must make sure that they use their eyes and ears to look and listen for danger signals to ensure their personal safety.

It is recommended that employees who need to be highly visible during the day should wear proper warning garments as described in the Caltrans Safety Manual, Chapter 12, Section 12.20. In addition to standard warning garments (vest, coveralls, etc.), employees who need extra visibility should wear white coveralls or ANSI Class III warning garments if necessary to increase their visibility.

### **8.15 Facing Traffic (Employees on Foot)**

Supervisors shall plan and supervise the work to minimize the amount of time employees will have their backs to traffic. A lookout should be used during these times to protect the employees while their backs are turned to traffic.

Unless there is a clear reason for doing otherwise, employees shall continually face oncoming traffic while working on or near the traveled way. This is the personal responsibility of every worker.

Facing traffic is the most important thing you can do to protect yourself and your co-workers while working on or near the traveled way. Facing traffic gives you a better opportunity to see and hear errant vehicles. This allows you a chance to move out of the way and warn fellow workers.

### **8.16 Crowding of Workers**

Supervisors shall plan work so that each employee has adequate space to work safely.

Supervisors shall ensure that employees know their responsibilities for positioning themselves so that each employee has enough work space to work safely and avoid being struck by flying material or another worker's tools.

Workers shall avoid "bunching up", which increases traffic exposure and causes public concern.

### **8.17 Warning Systems-Lookouts**

While working on foot on or near the traveled way, employees should normally be protected by protective vehicles/equipment, guardrail, or other physical means. Where the absence of such physical protection exposes workers on foot to errant vehicles, a person shall be assigned as a lookout according to circumstances described below.

1. A lookout shall be assigned if **all** of these conditions exist:
  - (A) Work occurs on a roadway with a posted speed limit of 55-mph or more.
  - (B) Workers are without physical protection.
  - (C) Two or more people working close to each other.
  - (D) Working within 30 feet of moving traffic.
  - (E) A person is on foot.
2. A lookout is required for short duration work if a protective vehicle or other physical barrier is not provided.

The lookout shall continually watch approaching traffic for errant vehicles that may hit workers on foot. If trouble is suspected, the lookout shall warn the workers by yelling, using a vehicle or warning horn, a portable lookout alarm device, or any system capable of communicating the warning message. This warning is intended to give workers the time to use a planned escape route to avoid the errant vehicle.

A lookout shall not be assigned any other duties.

Lookouts shall be rotated often enough to keep them alert.

The supervisor may use a crew lookout whenever he or she thinks it is needed. Even if workers are physically protected, using a lookout may be beneficial.

Electrical and mechanical detection systems may be used to supplement the human lookout.

Slope watchers shall be used when working under unstable slopes where rocks may fall and injure workers. These slope watchers shall not be assigned to watch the slope and to lookout for traffic at the same time. Refer to the Maintenance Code of Safe Operating Practices, Slope and Embankment Maintenance, and Appendix E, Cut Slope Safety and the Caltrans Safety Manual, Chapter 21, Cut Slope Safety.

## **8.18     Parking**

Before a vehicle is parked, the driver shall consider if the vehicle will be needed to perform the work. If not, the vehicle should be used for the physical protection of workers. If it is used for protection, refer to Section 8.11, Protective Vehicles. If it will not be used for physical protection or for work, the vehicle shall be parked where it will not affect passing traffic or interfere with the maintenance operation.

All vehicles should be parked on the same side of the highway (see Section 8.31, Maintenance Crews Working Across From Each Other).

If a vehicle is parked on the shoulder within 6 feet of a traffic lane on a multilane highway with a paved shoulder 8 feet or more in width for more than 20 minutes, then the shoulder must be closed as shown in Standard Plans T10. This is not necessary on city streets where parking is expected.

Whenever possible, enter or exit your vehicle on the side away from traffic, even though it may be harder to do so. This will reduce worker exposure. Avoid standing or working near the back or along the traffic side of vehicles. Also, workers should avoid working directly in front of vehicles due to the danger of roll ahead if struck.

### **8.19 Signs**

Advance warning signs shall be placed when a stationary operation is on the traveled way, or is on the shoulder within 6 feet of a traffic lane on a multilane highway with a paved shoulder 8 feet or more in width. Also, warning signs shall be placed well in advance of the work, when traffic slows, changes lanes, or moves from its normal course of travel because of the work. The standard signs shown in MUTCD and CA Supplement (Part 6) and in Standard Plans T10 through T17 shall be used.

Portable signs should be placed on sign standards with two (2) or more orange flags. The sign standard shall be in an upright position with the center of the sign panel a minimum of 5 feet above the pavement. A cone shall be placed next to each warning sign. If portable signs are displaced or overturned during the work, they shall be immediately replaced. Portable signs shall be held in position with approved weighing devices only.

Use your vehicle to protect yourself from traffic while setting and retrieving warning signs. A shadow vehicle should be used for setting and retrieving warning signs for freeway lane closures. A shadow vehicle shall be used as a protective vehicle during the installation and retrieval of traffic cones and signs in the taper and tangent sections of a lane closure.

When work is temporarily stopped or finished and traffic is not affected, all signs shall be promptly removed, dropped down, or turned away from traffic. Using signs when they are not needed reduces their effectiveness. In addition, installing them when they are not needed increases worker exposure to traffic.

Extra warning signs may be used when appropriate. For example, if queues are expected to develop in lane closures with reversible control, extra W3-4 “BE PREPARED TO STOP” signs can be used.

Placing an advance warning sign, such as a W20-1 “ROAD WORK AHEAD” sign, on the rear of a vehicle in the actual work area does not provide adequate warning to traffic, and is not permitted. However, an advance warning sign may be used on an advance warning vehicle.

Signs on vehicles with messages such as “WARNING – THIS TRUCK MAKES FREQUENT STOPS” are advisory only and do little to protect the workers. They should only be used on low speed roads or city streets. When this type of sign is used, an amber light or FAS in the caution mode shall be used along with it.

Signs, such as W8-7 “LOOSE GRAVEL”, W21-2 “FRESH OIL”, etc., may be placed on barricades. The barricades shall be ballasted either internally or by means of sandbags placed on the lower parts of the barricade frame or stays. The sandbags shall not be placed on top of the barricade or, over any retroreflectorized barricade rail facing traffic.

## **8.20     Flagging Operations**

Any time two-way traffic must share the same lane because of work in the other lane; a flagging operation must be set up. See Standard Plan T13.

Flaggers shall receive on-the-job training before going on duty and shall follow the flagging procedures described in Chapter 6C Temporary Traffic Control Elements and Chapter 6E Flagger control of the MUTCD and the CA Supplement. Flaggers will receive training and instructions based on the MUTCD and the CA Supplement and work site conditions that also includes the following:

- (1) Flagger equipment which must be used.
- (2) Layout of the work zone and flagging station.
- (3) Methods to signal traffic to stop, proceed, or slow down.
- (4) Methods of one-way traffic control.
- (5) Trainee demonstration of proper flagging technique and operations.
- (6) Emergency vehicles traveling through the work zone.
- (7) Handling emergency situations.
- (8) Methods of dealing with hostile drivers
- (9) Flagging procedures when a single flagger is used (when applicable).

The training needs to be documented.

Flaggers should be rotated and relieved periodically to maintain alertness.

In areas where flagger visibility is reduced, it is recommended that flaggers wear warning garments as described in the Caltrans Safety Manual, Chapter 12, Section 12.20. In addition to standard warning garments (vest, coveralls, etc.), employees should wear white coveralls or ANSI Class III warning garments if necessary to increase visibility. Additionally, flaggers shall stand where they are most visible to approaching traffic and avoid areas of shade, shadows, etc., whenever possible.

On some two-lane roads one flagger may be used to control traffic. Traffic volume must be light and the length of the one lane section should be short so that one end is visible from the other. The sight distance for approaching vehicles must be long enough that traffic can be safely controlled from one end of the work zone. This method must be approved by the supervisor.

The cones on the centerline shown in Standard Plan T13 may be eliminated at the supervisor's discretion if a pilot car is used or an approved deviation is in place (See 8.05). The pilot car shall have radio contact with personnel in the work area and the maximum speed of the pilot car through the traffic control zone shall be 25 miles per hour.

The minimum distance required between the flagger and the work area is listed in Table 1, Standard Plan T13.

Flaggers shall be used when the drivers vision is impaired because of smoke or dust in work zones. They shall also be used to protect trucks that must turn on the traveled way to load or dump. The flagging procedures in Chapter 6C Temporary Traffic Control Elements and Chapter 6E Flagger Control of the MUTCD and the CA Supplement shall be followed.

Where the end of a one-lane section is not visible from the other end, the flaggers shall use 2-way radios or other positive means to maintain control of traffic.

Except for unusual circumstances or emergencies, flaggers should not be used on freeways.

Traffic signals may be used to control traffic on two lane roads. The operation must conform to Chapter 4D Traffic Control Features of the MUTCD and the CA Supplement. Attention is directed to Figures 6H-12 and 6H-14 of the CA Supplement.

#### **8.20.1            Handling Emergencies Within the Work Zone**

##### **Warning signal for crew at the work area**

Prior to going out on the job, crews shall establish a warning signal for the work area crew in case of an emergency.

### **Emergency vehicles**

Supervisors shall ensure that all crew members are aware of the procedures to be used whenever emergency vehicles approach the flagger's station. Supervisors should also discuss emergency procedures with local law enforcement agencies, ambulance services, and fire departments. When certain types of work, such as blasting or extensive excavation makes the roadway impassable, advance arrangements should be made with the local police agency who has jurisdiction over the roadway.

When informed in advance of an approaching emergency vehicle, the flagger should clear an unimpeded path for the emergency vehicle by stopping traffic from all directions.

When no advance notice is given, first stop the emergency vehicle, and then stop all traffic including construction equipment to provide a clear path for the emergency vehicle to pass.

### **Violations of traffic control and hostile drivers**

Flagger should warn the workers that a driver has run the flagger station. Stop all vehicles entering the work area, but do not put yourself in an unsafe situation. Plan your escape route before an emergency occurs.

When dealing with hostile drivers, be courteous and professional. Do not get involved in an argument with motorists or pedestrians.

If a motorist fails to follow your instruction and threatens the safety of the work area, or is hostile, note the vehicle license number and description of the vehicle and driver. Report the information to your supervisor for the purpose of filing a police report.

### **Collisions in traffic control zone**

Flaggers must know how to handle collisions in traffic control zone and be prepared for emergency flagging operations.

In the event of a traffic collision, notify your supervisor and call for help.

If a collision happens in the line of waiting traffic, stay at your station and continue to control traffic until you receive instructions from your supervisor or a police officer.

If a collision happens within the controlled area, hold approaching traffic and follow instructions from the supervisor, the leadworker, or from a police officer.

## **8.21 Shoulder Closures**

Working on the shoulder of a highway requires caution and awareness. Employees have been killed or seriously injured being struck by errant vehicles leaving the traveled way. It is every employee's responsibility to be aware and watchful while performing work on the shoulder of any highway.

While working on the shoulder, keep a vehicle or other means of physical protection between yourself and approaching motorists. Do not stand or work at the rear of the vehicle at any time.

Shoulder closures are used to guide motorists around stationary operations on shoulders. A shoulder closure is optional on unpaved shoulders and two-lane roads. It must be kept in mind that shoulder closures provide no physical protection.

A shoulder closure is required for a stationary operation on a multilane highway with a paved shoulder 8 feet or more in width whenever vehicles or equipment are parked on the shoulder within 6 feet of a traffic lane. Shoulder closures are to be set up as described on Standard Plans T10.

For Short Duration shoulder operations of 20 minutes or less, signs/channeling devices may be eliminated if a protective vehicle with activated flashing amber light is used.

Shoulders used as part time lanes should be closed in the same way as lanes are closed.

A properly placed barrier vehicle shall be used with shoulder closures to protect workers.

## **8.22 Moving Lane Operations/Closures**

Before employees work in a moving lane closure, a discussion shall be held so that all involved employees will know what their role in the operation is and how to proceed safely.

In any slow moving operation the first vehicle in the lane approached by motorists shall be a shadow vehicle.

For information on vehicle spacing, vehicle positioning, and signing, refer to the Traffic Control System For Moving Lane Closure On Multilane Highways (Standard Plans T15 and T16) and on Two Lane Highways (Standard Plan T17).

All vehicles used as shadow trucks shall be equipped as defined in Section 8.11, Protective Vehicles. Radio communication in all vehicles is required.

Other requirements for moving lane closures and shadowing moving operations, found in the Maintenance Code of Safe Operating Practices, shall be followed.

Exceptions to this rule are tow trucks and snow removal/de-icing equipment.

### **8.23 Lane Closures**

A lane closure shall be set if a stationary operation takes more than 2 feet or reduces the width to less than 10 feet of an existing lane on a multilane highway. To take up to 2 feet of a lane on a multilane highway without a lane closure, a cone taper shall be installed that begins at least 300 feet upstream from the work area. The taper shall have 28 inch cones spaced 50 feet apart.

The lane of a two-lane highway shall be closed if work reduces the width of a lane to less than 10 feet. Traffic shall not be moved across the center stripe without a lane closure or other means of traffic control.

A space of 6 feet should be maintained, whenever possible, between moving traffic and the work area. When closing a lane, a barrier vehicle or a shadow vehicle shall be used for the installation of the signs and the FAS if they can be placed while off the traveled way on the shoulder or median. A shadow vehicle shall be used as the protective vehicle during the installation and retrieval of traffic cones and signs in the taper and tangent sections of the lane closure. All devices placed in areas with no shoulders from an open lane require the use of a shadow vehicle for protection.

Lane closures shall be placed according to the Standard Plan T10, Traffic Control System for Lane Closure on Freeways and Expressways or the Standard Plan T11, Traffic Control System for Lane Closure on Multilane Conventional Highways.

If a lane closure begins to cause traffic to back up (commonly called queuing), the advance warning signs shall be moved back in advance of queuing, or portable changeable message signing (PCMS) shall be placed and maintained in advance of the upstream end of queuing. If the signs cannot be moved back, or the use of a PCMS cannot be employed, the lane closure should be removed. If the lane closure results in a significant traffic delay, the closure may need to be removed.

A PCMS may also be used to redirect traffic and relieve queuing. The additional PCMS may be used at key interchanges and exit ramps and other locations where traffic queues may be expected due to maintenance activities.

If for some reason, a lane cannot be closed utilizing the requirements of this section, a deviation may be warranted. See Section 8.05, Changing Chapter Standards.

#### **8.24 Closing Auxiliary Lanes**

Work occurring at the beginning of an auxiliary lane such as a truck lane or lane added to increase capacity, will require as a minimum, the shoulder closure plan shown on Standard Plan T10 plus these additional requirements:

- (A) A W20-1 "ROAD WORK AHEAD" sign instead of the W21-5b "SHOULDER WORK AHEAD" sign on the shoulder upstream from the beginning of the auxiliary lane.
- (B) Cones on the shoulder stripe from the W20-1 sign continuously to the auxiliary lane line.
- (C) A C30 (CA) "LANE CLOSED" sign in the closed lane about 100 feet from its beginning and every 2,000 feet after that.

If the work site is a considerable distance from the beginning of the auxiliary lane and the above method is not practical, the lane shall be closed according to the Standard Plan T10. If the auxiliary lane is located at an exit ramp or connector, the closure plan in Standard Plan T14 shall be used.

#### **8.25 Standard Exceptions to Lane Closure Procedures**

(A) Limited Work on the Traveled Way, Without Lane Closures.

Short-Duration operations may be conducted on the traveled way without using a lane closure or signs. Pothole patching and debris retrieval, are examples of brief operations. To use this method all of the following conditions must exist:

- (1) The traffic volume must be light. This means the worker can walk from the shoulder to the site on the traveled way, do the job, and walk back to the shoulder without interfering with traffic.
- (2) Sight distance shall be at least 500 feet in each direction. Where 500 feet of sight distance is not available at the work site, one or more lookouts should be posted to extend visual coverage if necessary.

(3) Vehicles must be parked completely off the traveled way.

If all three of these conditions exist, the supervisor may instruct workers to perform the work on a specified section of highway without a lane closure. All of the following work methods shall be used:

- (a) When the crew consists of at least two (2) workers, one (1) of the workers shall act as a lookout. The lookouts exclusive duty will be to continually watch for approaching traffic and to warn the worker whenever trouble is suspected.
- (b) The lookout shall not carry a flag or paddle and shall do nothing to control or influence traffic. All workers shall be off the traveled way when traffic passes.
- (c) Only one (1) production worker shall be on the traveled way, unless more are needed to reduce the exposure time.
- (d) Workers shall face approaching traffic whenever possible.
- (e) Workers shall have a planned escape route.
- (f) A FAS in the caution mode or a flashing amber light shall be operating.

- (g) W20-1 “ROAD WORK AHEAD” signs are not required, since passing traffic is not to be affected.

**(B) Pavement Marking and Relamping Operations**

A supervisor may allow pavement marking and relamping operations on the traveled way without a lane closure. The posted speed limit must be less than 55 miles per hour and the work must take less than 20 minutes to complete. The supervisor may also use devices such as signs, barrier vehicles, and lookouts to increase worker protection.

**(C) Chain Controls**

Lane closures are not required in chain control operations. However, on multilane highways, they may be used to create a cushion between Caltrans workers and fast vehicles leaving the work area. In addition, a supervisor may use lookouts and barrier vehicles to increase worker protection.

**(D) Moving Shoulder Operations**

The supervisor may allow moving shoulder operations next to the traveled way without a lane or shoulder closure. Shoulder grading, mowing, and spraying operations are examples of moving shoulder operations. The work must leave at least 10 feet of the lane next to the shoulder open to traffic. On two-lane conventional highways, traffic shall not be moved across the center stripe without a lane closure or other means of traffic control.

**8.26 Flashing Amber Lights and Rotating Amber Lights**

Amber lights shall be used to alert motorists to work activity near, but not on, the traveled way. Amber lights are not to be used while driving at prevailing speeds, when parked in an established lane closure, or when no danger to the employee or motorist exists.

Warning lights, to be effective, must only be used when they are needed.

Flashing Amber Light includes such devices as flashing lights, rotating beacons, or light/stick bars.

Flashing and/or rotating amber lights are to be used on motor graders, snow removal equipment,

and other specialized equipment that are operated on the traveled way at lower than prevailing traffic speeds.

Flashing amber/rotating lights are to be used on pilot cars not having a FAS. A flashing amber light should not be used at the same time as a flashing arrow sign because the arrow becomes more difficult to read. If the vehicles are equipped with both, do not use at the same time. During the hours of darkness, or during periods of inclement weather, amber lights should be used with discretion. At times, the vehicle emergency flashers may be more effective.

### **8.27 The Use of the Flashing Arrow Sign (FAS)**

Arrow messages pointing left, right, or to both sides, are to be used as action messages. An arrow is to be used only when requiring the motorist to change lanes. An arrow message is not to be used when a vehicle is parked in a closed lane unless it is being used for the arrow closing that lane.

The terms "arrowboard" and "flashing arrow sign" are synonymous. The Type I is approximately 8 feet x 4 feet , trailer mounted FAS. The Type II is approximately 6 feet x 3 feet ,vehicle mounted FAS. Flashing Arrow Signs have several modes. The caution mode has four lights flashing and the arrow modes flash right or left.

A FAS in the arrow (ALL lamps forming the arrowhead and shaft shall flash on and off simultaneously) or chevron mode may be used for stationary or moving lane closures. During hours of darkness, the FAS shall be dimmed to prevent blurring of the arrow image.

To alert the motorist to work activity near, but not on the traveled way, the caution mode of the FAS is to be used.

Any shadow vehicle working on the traveled way of a multilane highway outside of a lane closure must be run with a FAS board in an arrow mode.

Work vehicles that are being shadowed should usually not display a FAS. Two partially superimposed FASs may not give a clear message.

### **8.28 Placing the Flashing Arrow Sign (FAS)**

The flashing arrow sign (FAS) should be placed on the shoulder at the beginning of the taper as shown in Standard Plan T10. If there is no shoulder, the FAS should be placed as close to the beginning of the taper as possible. A minimum 1500 feet of sight distance shall be provided where possible for vehicles approaching the first FAS.

If the FAS cannot be located properly, consider placing the taper in a different or safer location.

In multilane closures on freeways and expressways (Standard Plan T10), one FAS must be used for each lane closed. The first FAS used should be a Type 1. The second and succeeding FAS may be either a Type 1 or Type 2.

### **8.29 Working Equipment Against Traffic**

Operating equipment against traffic is permitted when working on the shoulder or within a lane closure. This may be desirable in some cases, such as during crack sealing operations, where employees would have the added protection of the work vehicle between themselves and approaching traffic. Headlights shall be turned on during the daylight hours when working against traffic. They should be turned off at night when working against traffic, because they might confuse motorists.

### **8.30 Access to Median Work Zones**

- (A) Workers should not walk across traffic lanes to work in median areas. They shall drive into the median area and park when possible. However, the width and condition of the median must be considered. If the area is too narrow, wet, sandy or is difficult to accelerate from, it should be avoided.
- (B) If it is not possible to park in the median area and crossing on foot is necessary, the following rules must be followed:
  - (1) Workers shall not run. They shall wait for a break in traffic adequate to allow them to walk across the lanes.
  - (2) Workers shall not carry tools or items that would slow them down and make the crossing unsafe.
  - (3) If the traffic is too heavy and a traffic break is not available, workers shall wait for a safer time to do the job. If they must cross, they shall call for traffic control or ask for a CHP traffic break.

### **8.31 Maintenance Crews Working Across From Each Other**

Maintenance crews shall not work on opposite sides of a highway, directly across from each other.

The intent of this guideline is to prevent the channeling of vehicles traveling in the same direction on a freeway or causing vehicles to cross the centerline of a two-lane highway.

Crews shall not perform work directly across from each other on opposite sides of a highway unless there is a median barrier or other divider. (For example, tree crew in shoulder closure working directly across from crew in the #1 lane). A distance of at least 2,000 feet must be kept between operations if work must be accomplished at the same time.

However, if flaggers, stop signs, or traffic signals positively control the traffic, the work sites can be closer.

NOTE: This applies to stationary operations and not when a moving operation, such as sweeping, striping, or spraying, temporarily passes a stationary operation.

### **8.32 Picking Up Litter and Debris**

Normally, the safest way to pick up litter is to work individually and always face approaching traffic. Trucks should be parked away from the work area unless needed to provide protection from traffic. The workers may be dropped off and picked up later. The practice of employees walking beside a truck loading litter with a pitchfork or other hand tool should be avoided.

In narrow medians, protective vehicles may be necessary at both ends of the work area.

Litter bags should not be filled so full that they are too hard to lift. The bags should be placed where workers can easily pick them up with minimum exposure to traffic. When possible, the bags should be stockpiled to reduce the number of stops needed for bag removal.

Do not place hypodermic needles in litter bags. For more information, refer to the special instructions for the Disposal of Hypodermic Needles in the Maintenance Code of Safe Operating Practices. Other sharp objects, heavy metal objects, tire caps, or concrete chunks should not be placed in litter bags. These items could seriously injure the person who picks them up.

When retrieving debris from a freeway lane, workers shall wait for a break in traffic. A break in traffic is defined as all lanes clear of traffic long enough for the employee to walk out, retrieve the debris, and walk back to the shoulder. If no traffic breaks occur, contact the CHP to provide one.

Workers shall not try to flag traffic, use hand signals, or otherwise attempt to create a traffic break.

When debris is retrieved from the traveled way, workers shall follow these guidelines:

- (A) Workers shall remain in the vehicle until the traffic break approaches.
- (B) An escape route shall be planned before leaving the vehicle. The vehicle shall not be parked where it will block the workers' escape route.
- (C) When workers are on foot, their vehicle shall be kept between themselves and approaching traffic. Workers shall walk on the outer edge of the shoulder, staying as far from moving traffic as possible.
- (D) Workers shall always face approaching traffic.

The above procedures, except the traffic break, should be followed when removing debris from shoulders.

### **8.33 Night Work**

Extra caution is necessary at night when both motorist and worker visibility is reduced.

Each employee must be informed about the hazards of working at night. Careful planning is necessary, and all the potential problems that may be encountered while working on or near the traveled way should be considered. The use of MAZEEP will enhance the protection of workers in lane closures.

During the hours of darkness, workers on foot must wear the proper warning garments as described in the Caltrans Safety Manual, Chapter 12, Section 12.20, which includes white coveralls with reflective striping, white coveralls with the standard reflective vest, or ANSI Class III vest and pants.

The rain gear jacket shall be reflectorized for nighttime wear. Reflective material may also be worn on hard hats.

Sufficient light should be provided at the work site. Light plants, floodlights, or work lights shall be mounted and directed in a manner to allow employees to work safely and to prevent glare to approaching traffic.

Because of the risk to workers, nighttime call outs should be kept to a minimum. If there is no danger to the public, environment, or roadway, repairs should wait until the next day. For example, if the damaged facility does not encroach on paved shoulder areas or is more than 3 feet from the traveled way in unpaved shoulder areas, there should not be a nighttime call out except to place barricades. It is up to the supervisor to decide when it is appropriate to call out a crew for quick, temporary repairs, or to wait until daylight.

Call outs should be made when warning or regulatory signs have been knocked down and pose immediate danger to the motorist. Also, supervisors should consider responding at night for broken water lines, damaged phone or electrical lines, or spills where environmental damage may occur.

Each district will advise all local law enforcement agencies of this call out policy.

During nighttime lane closures, all traffic cones shall be retroreflective as described in Chapter 6F of the MUTCD and the CA Supplement.

All warning signs used at night shall be made with high performance retroreflectorized sheeting.

During hours of darkness, the lights on the Flashing Arrow Sign shall be dimmed to prevent blurring of the arrow image.

#### **8.34      Transportation of Workers**

Workers shall be transported in vehicles equipped with seats and seat belts. Workers shall not be allowed to ride in the beds of dump trucks, buckets of loaders, on the sides or running boards of vehicles, or any other place on a vehicle or equipment that was not designed for driving or riding.

#### **8.35      Operating Maintenance Equipment**

Employees must be properly licensed, trained, and qualified prior to operating equipment unsupervised. META (Maintenance Equipment Training Academy) guidelines for the Qualification Program are available in the Division of Maintenance web pages. District META coordinators may be contacted for assistance in locating the nearest Qualifier or Trainer.

#### **8.36      Backing of Vehicles and Equipment**

Backing accidents have always been the most prevalent type of vehicle accident. Because so many of the tasks Maintenance employees perform involve the backing of vehicles and equipment, the potential for serious accidents exists, and extra emphasis must be placed on preventing their occurrence.

Methods to avoid backing accidents should be discussed at regularly-scheduled crew tailgate safety meetings. Any close calls that occur should be discussed, along with ways to prevent a recurrence.

**A. Prior to Job/Planning the Work**

- 1) Supervisors should plan work projects to minimize the need for backing of vehicles and equipment whenever possible. For example, the forward mode of cone retrieval should be utilized for retrieving lane closures.
- 2) Design the work space to eliminate or decrease backing and blind spots; when feasible pull trucks into the work zone and let the operation catch up to them.
- 3) At tailgate safety meetings, prior to the job, discuss how and when vehicles will be backing within the work zone and specific measures that will be taken to prevent an accident.

**B. Safety at the Worksite**

- 1) Workers on foot will be separate from equipment as much as possible: ensure that employees on foot stay out of the work area and in clear view of those who are operating equipment.
- 2) Minimize the distance heavy equipment needs to back up in order to gain access to the work area.
- 3) Employees should never move equipment without making positive visual contact with any workers on foot around or near the equipment.
- 4) In work zones where moving equipment has the potential to strike a worker on foot, employees shall not place themselves in or near the path of backing vehicles and should not enter the work area until it is clear for hand work. One person should be designated as a lookout while vehicles/equipment are moving within the work area.
- 5) Every backing situation is new and different. Even if you work at the same location several times a day, you should be watchful for changes and any new obstacles.
- 6) Use a spotter. The driver and spotter should use hand signals instead of verbal ones and make sure they understand each other's signals. Don't have the spotter walking backwards while giving instructions.

- 7) During shoulder or pavement rolling operations, make sure all workers on foot are clear of the work area before moving any vehicles/equipment.

**C. Personal Responsibilities**

- 1) Employees operating vehicles and equipment must be familiar with the blind spots for the particular equipment they are operating. Remember that mirrors can never give the whole picture while backing.
- 2) Train workers on foot and equipment operators in appropriate communication methods (e.g., using hand signals and maintaining visual contact) to be used when workers on foot are required to be in the same area as equipment.
- 3) Do a walk-around of your vehicle before entering. Check for obstructions, low-hanging trees and wires, and any other potential clearance-related problems.
- 4) On-foot personnel need to make sure they are a safe distance from vehicles in the work area. Do not stand where the operator cannot see you; a vehicle that has the potential to back up could run you over.
- 5) Although a flagger's primary job is to control traffic, they could assist workers on foot by acting as an additional lookout at the jobsite.

**D. Working with Vendors/Contractors**

- 1) When working with others who may not be a part of your crew, you must realize that their safety practices and procedures may be different than ours. This becomes especially important when vendor vehicles are backing within your work zone.
- 2) Discuss backing procedures and practices with the affected personnel/vendors before the job begins, if possible. If not, use extra caution when vendor vehicles enter the work area.
- 3) Make sure that vendor trucks and equipment operating in your work area have functioning back alarms. If they don't have a back alarm or it isn't working properly, tell your supervisor immediately, tell your co-workers, and also advise the driver.
- 4) If possible, designate a lookout to monitor vendor truck movements, especially if the task involves backing into an asphalt paver, backing from a staging position, or similar activity where employees are on foot in the work zone.

### **8.37 Working on Machinery and Equipment**

Workers shall not work on electrical or mechanical equipment unless they are properly trained and authorized by their supervisor to do so.

Every power driven machine equipped with lockable controls or readily adaptable to lockable controls shall be locked out or positively sealed in the “off ” position during repair, servicing or adjusting work. Machines not equipped with lockable controls or readily adaptable to lockable controls shall be de-energized or disconnected from its source of power. In all cases, accident prevention signs and/or tags shall be placed on the controls of the machines during repair work.

No one shall remove the tag or unlock the switch except the person who placed it.

During repair, machines or equipment shall be effectively blocked or otherwise secured to prevent accidental movement if such movement can cause injury to employees. For example, before working underneath any vehicle and/or equipment to adjust or inspect it, steps shall be taken to ensure that the vehicle cannot move. Shut off the engine, set the brakes, and physically block the wheels with wheel chocks before any work begins.

Remove the keys from the vehicle and place a “Do Not Operate” tag in the ignition switch, on the steering wheel or some other very visible location. When working on a motor grader or other equipment that has implements such as blades, plows or buckets attached, you must lower them to the ground or block and/or chain them up before working underneath them.

Never get under a vehicle or equipment supported only by a jack or held up only by the equipment’s lifting system. Use an approved safety stand or other device designed to support the load. Do not use makeshift or homemade devices or unstable materials.

Do not work under a raised dump bed or other raised vehicle bed, unless the safety stand is in place. Raise the bed, place the stand in its holder and lower the bed onto the stand before beginning the work.

Depressurize air and hydraulic hoses before working on them. Do not search for hydraulic leaks with your hands; use a piece of wood or cardboard. Hydraulic fluid or air under pressure could enter your skin and cause serious injury.

Bleed pressure on spray tanks before opening or working on them. This includes chemical spray tanks, emulsion tanks on trucks or trailers, and even Hudson-type pump sprayers.

Before adjusting, cleaning, or repairing brush chippers, read the operators manual and take steps to ensure that all potential energized parts have been locked out. This includes the guillotine guards on those so equipped and all parts of the rotating drum.  
Do not operate equipment or machinery without the required guards or shields in place.

During adjusting or cleaning operations, never reach into the operating equipment. Use an extension tool or other means of removal if necessary—not your hands.

This information is provided to help employees comply with the General Industry Safety Orders, Section 3314, Cleaning, Repairing, Servicing and Adjusting Prime Movers, Machinery and Equipment.

### **8.38 Tailgates of Trucks**

Each year, employees are injured (smashed fingers) removing debris or rocks from dump truck tailgates. Do not use your hands or fingers to clear debris from the tailgates of dump trucks. Use a shovel, digging bar, or other tool to remove debris.

### **8.39 Compressed Air**

When using compressed air, always wear safety glasses.

Never use compressed air to transfer liquids from one tank to another unless tanks are designed for such service.

At no time shall compressed air be directed toward a person. When compressed air is used, all necessary precautions shall be taken to protect persons from injury. Do not use compressed air to “blow down” clothing or skin. Compressed air nozzles must be of the safety type that limits pressures to 10 psi or less.

Tanks or drums not designed for use as compressed air tanks shall not be filled with compressed air.

Air hoses shall be checked regularly to ensure that they are in good condition. Cracked or leaking hoses shall be removed from service and replaced. Compressed air tanks should be checked and drained weekly or more often if conditions warrant.

Compressed air-tank operating permits should be conspicuously displayed and kept current. Air tanks shall be inspected as required by the Unfired Pressure Vessel Safety Orders, 8CCR Section 461.

All compressed air equipment and plumbing shall meet the requirements of the Unfired Pressure Vessel Safety Orders.

Compressors that start automatically require a warning sign.

#### **8.40     Work On Electrical Circuits**

Only qualified and trained persons shall work on electrical equipment or systems. All work performed directly on or in proximity to electrical installations, equipment or systems operating or intended to operate at 600 volts or less shall comply with the Low Voltage Electrical Safety Orders. All work performed on systems operating at more than 600 volts shall comply with the High Voltage Electrical Safety Orders.

The Codes of Safe Operating Practices for work performed on electrical equipment or systems contain more information on the specific hazards and on the proper safety procedures to follow while performing the work. Never work on energized electrical systems unless you are properly equipped and trained to do so.

This section does not apply to installations of conductors and equipment in vehicles operating at less than 50 volts, or to their ignition systems.

**8.41 Working Near Utilities**

(A) Overhead Utilities:

Workers shall not be required or permitted to perform any function in proximity to energized high voltage lines. Any activity where any parts of tools, machinery, or materials that an employee is touching or any part of an employee's body will come closer than the minimum clearances from energized overhead lines set forth in the following table is prohibited. Employees who work in proximity to or will come within the clearances of the table of any overhead lines will be trained in the hazards and identification of types of overhead lines. If lines are low voltage (less than 600 volts) a minimum clearance of 3 feet will be maintained at all times unless lines are de-energized and grounded. All overhead lines will be considered energized unless de-energized and grounded at the site by the utility operating the line.

Boom equipment must not be operated where the boom could come within the minimum required clearance set forth in this table. Hoisting over energized lines is prohibited.

<b>Nominal Voltage (Phase to Phase)</b>	<b>Minimum Required Clearance (Feet)</b>	<b>Minimum Required Clearance (Meters)</b>
<b>600 .... 50,000</b>	<b>10</b>	<b>3</b>
<b>Over 50,000 .... 75,000</b>	<b>11</b>	<b>3.4</b>
<b>Over 75,000 ... 125,000</b>	<b>13</b>	<b>4</b>
<b>Over 125,000 ...175,000</b>	<b>15</b>	<b>4.6</b>
<b>Over 175,000 ... 250,000</b>	<b>17</b>	<b>5.2</b>
<b>Over 250,000 ... 370,000</b>	<b>21</b>	<b>6.4</b>
<b>Over 370,000 ... 550,000</b>	<b>27</b>	<b>8.2</b>

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<b>Over 550,000...1,000,000</b>	<b>42</b>	<b>12.8</b>
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Figure 8-2: Overhead Utilities

If downed power lines are located, workers shall not try to move or repair them. They shall stay clear and call the experts; normally, the local power company will respond.

(B) Underground Utilities:

Before any digging or excavations are begun, the area shall be checked to determine if there are any buried utilities. Some examples of digging or excavations requiring checking would be installing a new sign post, guide marker, snow pole, shoulder grading or ditch/culvert cleaning.

Utility markers or buildings that have no above ground source of power can indicate underground utilities. If the excavation will be conducted in an area which is known, or reasonably should be known, to contain subsurface installations, only hand tools shall be used for digging.

The Superintendent or supervisor shall notify the appropriate Regional Notification Center for operators of subsurface installations at least two (2) working days, but not more than 14 calendar days, prior to commencing any excavation with power tools.

The Regional Notification Centers include but are not limited to the following:

<u>NOTIFICATION CENTER</u>	<u>TELEPHONE</u>
Underground Service Alert Northern California (USA)	1-800-642-2444
Underground Service Alert Southern California (USA)	1-800-422-4133

If the excavation will be conducted in an area which is known, or reasonably should be known, to contain Caltrans electrical facilities, the Superintendent or supervisor shall notify the Electrical Supervisor for the area, prior to commencing any excavation.

In all cases, location of underground utilities, or a clearance, will take place before excavation or digging begins.

## 8.42 Ladders

Ladders shall be maintained in good condition at all times. The joint between the steps and side rails shall be tight, all hardware and fittings securely attached, and the movable parts shall operate freely without binding or undue play.

Metal ladders shall not be used while working on electrical equipment. All metal ladders shall be marked with a sticker or stencil that clearly says: “Caution–Do Not Use Around Electrical Equipment.”

Supervisors shall periodically inspect ladders for wear and damage. All ladders shall be cleaned of oil, grease, or slippery materials. Ladders which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as ‘Dangerous, Do Not Use’.

When using ladders, always face the rungs and use both hands. Do not carry materials or equipment while using a ladder.

## 8.43 Confined Spaces

Workers need to be aware of confined spaces and their hazards.

A confined space is any enclosed location where:

- (A) An employee can physically enter, **and**
- (B) Has limited or restricted means of entry or exit, **and**
- (C) Is not designated for continuous employee occupancy.

**For Caltrans employees, confined spaces include enclosed locations such as tanks, sumps, drain inlets, bridge cells, shafts, pits, bins, tunnels, tubes, pipelines, trenches, vaults, vats, pump houses or compartments, sewage lift stations, culverts, or similar type enclosures.**

No person will be allowed to enter a confined space unless all workers involved have been trained in the hazards, operating and rescue procedures, the Caltrans Confined Space Program (Chapter 14 of the Caltrans Safety Manual), and the Maintenance Confined Space Entry Procedures (Appendix B in the Maintenance Code of Safe Operating Practices). Additionally, no entry will be permitted unless the necessary air monitoring has been done, and a “Confined Space Entry Form” (PM-S-0040) has been completed. Supervisors must ensure workers are properly trained, and that the confined space operating procedures are being followed.

**NOTE:** Caltrans employees will not enter confined spaces with known or expected hazardous atmospheres—such as oxygen < 19.5% or > 23.5%, LEL > 1%, Hydrogen Sulfide > 10 ppm, Carbon Monoxide > 25 ppm. If employees experience symptoms of over-exposure---GET OUT---then attempt to determine cause. Contact the supervisor and the Safety Office for assistance.

All employees who will enter a confined space or are involved with confined space operations must be trained in Confined Space Safety every two (2) years.

#### **8.44 Trench And Excavation Safety**

Employees shall review Appendix D “Trench and Excavation Safety Guidelines” in the Maintenance Code of Safe Operating Practices before digging, drilling, or working in or near trenches or excavations. Supervisors shall ensure employees understand and follow these guidelines.

Caltrans workers shall not enter any trench or excavation until a supervisor or Superintendent has inspected the trench/excavation and the surrounding area to identify and/or correct any hazards. The supervisor or Superintendent must be competent and knowledgeable about soil classification, shoring/sloping techniques and requirements, access requirements, and the hazards of underground work. The inspection will be documented.

All trenches/excavations 5 feet or more in depth must be shored or sloped. Shallower trenches/excavations must be shored or sloped if needed. Also, a proper means of access (ladder, ramp, etc.) is required for all trenches/excavations.

If there is any doubt about the safety of an excavation, DO NOT ENTER. Obtain an engineering opinion and/or safety review before any work starts.

All work in trenches/excavations shall comply with the Construction Safety Orders, Article 6, Excavations (8CCR Sections 1540-1543).

#### **8.45 Use of Reclaimed Water**

Before employees use reclaimed water, they shall be told about the potential health hazards involved with contact or accidental ingestion of reclaimed water. They shall also be trained how to properly clean up after using it.

Reclaimed water must meet applicable coliform and health standards before it can be used by Caltrans personnel for irrigation or dust control. The county health department shall be contacted for guidance.

Contact with reclaimed water shall be kept to a minimum. Workers shall use impermeable (rubber) gloves and appropriate protective clothing. Supervisors should contact the local supplier to determine what other specific precautions should be taken.

Employees must have clean water and soap available at the work site when using reclaimed water. Workers shall be instructed to wash their hands thoroughly before eating, drinking, smoking, or going to the bathroom.

More information on the use of reclaimed water is found in the Maintenance Code of Safe Operating Practices.

#### **8.46 Handling Chemicals and Hazardous Substances**

Employees handling or exposed to hazardous materials will be trained in the hazards, proper handling, use, and disposal of the material before use. The Material Safety Data Sheet (MSDS) shall be reviewed and readily available. See Chapter 16, “Hazardous Materials Communication Program” of the Caltrans Safety Manual for specific requirements.

Employees responding to highway spills will follow Chapter “D5” of the Maintenance Manual, Volume 1, the First Responder Operations Reference Manual, and the Emergency Response Guidebook.

All disposal and storage of waste will comply with the Maintenance Hazardous Waste Manual.

Use of pesticides/herbicides will comply with Chapter “C2”, Vegetation Control, of the Maintenance Manual, Volume 1.

Contact the supervisor, safety office, Maintenance Hazardous Materials Coordinator, or Maintenance Landscape Specialist, for additional help or assistance.

#### **8.47 Radioactive Incidents**

See Chapter “D5” – “Spills of Substances on Highway Rights of Way” and the First Responder Operations Reference Manual.

#### **8.48 Explosives**

Care in handling and storing explosives are specified in Chapter 5 – Blasting.

**The Standard Plans T-10 through T17 contained in this Chapter 8 booklet have been printed utilizing the English measurement system. Any questions regarding these plans shall be directed to Headquarters/District Traffic Operations.**

<b>APPENDIX</b>	<b>T10 - Traffic Control System For Lane Closure on Freeways and Expressways</b>
<b>APPENDIX</b>	<b>T10A - Traffic Control System For Lane And Complete Closures on Freeways and Expressways</b>
<b>APPENDIX</b>	<b>T11 - Traffic Control System For Lane Closure on Multilane Conventional Highways</b>
<b>APPENDIX</b>	<b>T12 - Traffic Control System For Lane Closure on Multilane Conventional Highways</b>
<b>APPENDIX</b>	<b>T13 - Traffic Control System For Lane Closure on Two Lane Conventional Highways</b>
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Original signed by  
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## **9.00 Introduction**

Outdoor Advertising, to control the placement and maintenance of outdoor advertising displays that can be viewed from the State's interstate and primary highway systems, is administered by Headquarters Traffic Operation Division.

### **9.01 Removal of Illegal Advertising Displays within the Right of Way**

Maintenance forces are authorized to remove and destroy any advertising display, placed within the right of way without a Removal Authorization from the Headquarters Traffic Operation Division. Advertising displays may be stored at the nearest maintenance yard for 30 days, during which time the owner may claim the display.

### **9.02 Removal of Illegal Outdoor Advertising Displays on Private Property**

The Outdoor Advertising Act empowers the Director to remove illegal displays from private property. Maintenance forces are authorized to remove such displays upon request by the Headquarters Traffic Operations Division. Outdoor Advertising removal requests are sent to Region/District Divisions of Maintenance by memorandum requesting removal, a listing of display(s) to be removed, the citation(s) and the Removal Authorization Form(s) (ODA-0015) to be completed and returned to the District Division of Traffic Operations. If the removal crew finds that the violation has been corrected, no further action will be taken. The Removal Authorization Form must be returned to Headquarters Traffic Operations Division with a notation that the violation has been corrected. If for some reason, the removal crew is unable to remove a display, the reason should be noted on the Removal Authorization Form, which should immediately be returned to the Headquarters Traffic Operations Division.

The Removal Authorization Form includes Cost of Removal. The cost of all field work involved in the removal and destruction of illegal outdoor advertising displays from private property by Maintenance forces shall be charged to Source 52465, Expenditure Authorization 952130, Activity 040. This information should also be included on the Cost of Removal portion of the removal Authorization so that Headquarters Traffic Operations Division can bill the violator for removal of the display.

# CHAPTER 10

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## **10.00 Introduction**

The Caltrans Maintenance Division Asset Management Program is composed of a group of interrelated management tools that provide a basis for planning, scheduling, operating, and controlling the State's highway maintenance effort with economy and effectiveness. The use of this system places continuing emphasis on the economic utilization of personnel, equipment and materials within the resources available to each Maintenance Manager, Area Superintendent and Maintenance Supervisor.

### **10.01 Asset Management**

Four main systems comprise the backbone of the Caltrans Maintenance Asset Management Program:

- (A) The Integrated Maintenance Management System (IMMS) is a management system that allows the Maintenance Division to effectively plan, perform, and manage maintenance work. Maintenance "Activities", which must be performed to maintain the assets, have been defined and grouped into fifteen "Families." Fourteen of these Families are used to track expenditures against the Maintenance Division allocation. One Family, the "Y" Family, is used to record charges when Maintenance forces are doing work for others. Instructions for recording Maintenance work are outlined in detail in the Maintenance Manual Volume 2.
- (B) The Level of Service (LOS) evaluation system, LOS 2000, helps determine how well Maintenance Division resources are able to keep up with the demands on assets.
- (C) The Pavement Management System (PMS) provides systematic, objective evaluation of pavement condition that justifies Maintenance capital budget needs and helps set project priorities.
- (D) The Bridge Management System (BMS) inventories Caltrans bridge assets, tracks inspection results, tracks work completed, and forecasts bridge maintenance and construction needs.

These components must work together as a system in order for the Maintenance Division to achieve its objectives.

## **10.02 Maintenance Defined**

The legal definitions of maintenance as shown in Section 27 of the Streets and Highways Code includes the following:

- (A) “The preservation and keeping of rights of way, and each type of roadway, structure, safety convenience or device, planting, illumination equipment and other facility, in the safe and usable condition to which it has been improved or constructed, but does not include reconstruction or other improvements.”
- (B) “Operation of special safety conveniences and devices, and illuminating equipment.”
- (C) “The special or emergency maintenance or repair necessitated by accidents or by storms or other weather conditions, slides, settlements, or other unusual or unexpected damage to a roadway, structure or facility.”
- (D) “The degree and type of maintenance for each highway, or portion thereof, shall be determined at the discretion of the authorities charged with the maintenance thereof, taking into consideration traffic requirements and moneys available.”

## **10.03 Maintenance Levels**

The maintenance level is affected by many variables such as climatic conditions, traffic density, terrain, pavement types, geographical location, and the age of the facility. In addition, the maintenance level is also influenced by the type or class of road (freeway, expressway or conventional), its surrounding environment, characteristics, and density of traffic.

It is recognized that any defined level or quality of maintenance must be tempered by the judgment and experience of those responsible for maintaining the State highway system. It is imperative that these factors are considered, commensurate with the function of the facility maintained.

These levels are not designed to, nor do they establish a legal standard of care. They are published solely for the information and guidance of the employees of the Department of Transportation. They are subject to modification as conditions warrant.

Maintenance personnel should be constantly alert in their travels to detect and report deficiencies to, or needs of, the highway system. State highway facilities maintained in total or part by forces of other agencies should be maintained in conformance with State maintenance levels. Facilities of other agencies maintained by State forces should be maintained to the same level as State highway facilities unless otherwise directed by the agency responsible.

To ensure the overall levels of maintenance are pursued, periodic inspection trips by key personnel are recommended.

The Supervisor or a specifically designated member of the crew should travel over all highways in the section, including ramps and collector systems, at least once a week to observe overall conditions and detect deficiencies. Known or potential problem areas may require more frequent inspections.

The weekly inspections will be an integral part of the supervisor's work planning and scheduling activities.

The Area Superintendent should observe overall conditions within his or her area of responsibility to assure conformance with the established maintenance levels. Facilities maintained by other agencies should be reviewed by designated Maintenance personnel for conformance with maintenance levels as required, or at a minimum of once a month.

# CHAPTER 11

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## **11.00 Introduction**

The project development process is used to deliver Caltrans projects under both the Capital and Maintenance Programs using a contractor. Projects can be of varying scope and duration. Depending on the scope of the project and type of funding involved, it is a process that could take a long time.

The project development process can be broadly classified into five phases: Planning, Environmental, Right of Way, Design and Construction. Based on the scope of the project, the amount of effort in each of these phases will vary. Input from Maintenance is important during each of these phases, irrespective of the project funding source. Internal to Caltrans, Maintenance is the final customer of the project development process.

Maintenance staff should have a general understanding of the project development process and be familiar with the key players involved in the delivery of a project. During each phase of the project, a different group of people will be actively working on the project. However, the one person who will be the lead through various phases of the project is the Project Manager. The Deputy District Director, Maintenance, Region Manager, Area Superintendent, and Maintenance Supervisor should be aware of the name and contact information of the Project Manager for each project in their area.

No matter what program is used to build projects within the State right of way, Maintenance staff must be aware of the projects and be actively involved in all phases. Maintenance staff will ultimately be responsible for maintaining the State highway system unless if agreed upon by a Maintenance Agreement. Note, even with an agreement, Maintenance is still responsible to make sure the system is maintained as stated in the agreement.

## **11.01 Planning Phase**

The Planning phase is the first phase in a project after a project is initiated and a preliminary determination is made to pursue the project. Projects are initiated in many ways. The Planning Division, in conjunction with the local transportation authority, or a private developer, can initiate a project. Maintenance staff can initiate a project based on the needs of the pavement or roadsides. Also, some projects are initiated to address safety concerns.

Regardless of how the project is initiated, the Planning phase is the most critical time for Maintenance to be involved. During this phase, the project scope is developed and is the best time for Maintenance to bring to the attention of the Project Team the specific known deficiencies, items needing improvement, things that need to be added within the project limits, and suggestions for project features that could increase Maintenance employee safety in the future. Representatives from Maintenance should participate in project team meetings to provide valuable input in the development of the project scope.

This is the time to get items added to the P.I.D. documents; e.g. PSR,PS,PSSR, so that during the design stage, monies will more likely be available to accomplish the needs identified in the pids.

For example:

**Roadside Management Improvement and Safety Items**

- Paving of narrow areas.
- Paving gore areas and extending of existing gore paving.
- Pavement under guard rails.
- Treatment under roadside signs.
- Mow strip along fences.

**11.02 Environmental Phase**

In the Environmental phase of the project, the environmental clearances are obtained from various agencies to proceed with the design and construction of the project.

During this phase of the project, all of the environmentally sensitive resources within the project limits are identified. Maintenance staff should become familiar with the location of these resources and should also evaluate the impact of these resources on their routine operations. Based on the resources identified and impact mitigations identified, modifications might be necessary to the design of the facilities. For example, Maintenance staff could request the Design staff to plan for a fence around an environmentally sensitive location as part of a project, so that in the future Maintenance staff would not accidentally disturb a particular area during routine operations once the project is completed.

Maintenance staff should meet with the Project Manager and the design staff during this phase to identify areas within the project limits for which Maintenance needs environmental clearances.

### **11.03 Right of Way Phase**

In the Right of Way phase, the right of way required to construct the project is obtained. This is also the phase where easements and permits to enter adjacent private property are obtained.

During this phase, Maintenance staff needs to make sure they have enough rights of way to perform their routine operations on planned features such as soundwalls, drainage ditches, etc. Any facilities requiring access from outside the State highway right of way should be brought to the attention of the Project Team. With adequate lead time, Division of Right of Way staff should be able to obtain the appropriate permits, permanent easements, or additional right of way, so that Maintenance staff can perform their routine activities without trespassing on private property.

### **11.04 Design Phase**

During the Design phase, Design staff will prepare the plans, specifications and estimates of the project. If necessary, the District Maintenance Engineering staff will review and interpret the plans and specifications for Maintenance field staff.

Of all the stakeholders involved in a project, Maintenance field employees are most familiar with the existing conditions of the highway. During this phase, it is highly beneficial for Maintenance field and engineering staff to meet periodically with the Design staff in the field to review problems or areas of concern within the project limits. For example, poor drainage conditions, which Maintenance is familiar with, may not be obvious when the design staff perform their independent field reviews. Through joint cooperation between Design and Maintenance, problem areas can be identified and corrected during the Design Phase.

Also review landscape planting and irrigation plans to make sure they meet the needs of Maintenance as well as the public. A few examples of items to look for:

- Plant materials have been planted following the “Plant Setback and Spacing Guide.”
- Trees have been planted to ensure that they will meet clear recovery visibility clearance requirements over their lifespan.
- Design should accommodate typical maintenance practices and equipment, e.g., not interfering with pulling hoses, mowing, edging and minimizing the need to maintain slope and recovery areas.
- Planting shall maximize cover (including adequate on center spacing) by the end of the three (3) year plant establishment period.
- Mulch is a temporary weed suppression method until plants fill in.

- Planting and irrigation design shall reflect the Department's goal of reduced pesticide use.
- Maximize use of overhead irrigation to enhance safety and maintainability. Whenever possible, include the placement of irrigation mains, wire and laterals away from shoulders to reduce possible damage caused by future construction or vehicles parked on the roadside and allow safer maintenance.
- Trees located in overhead watered groundcover areas must be provided supplemental basin irrigation.

The schedules for most projects allocate time and resources for constructability, maintainability, and safety reviews. Maintenance staff should participate in these reviews for all projects within their areas. Contact the Project Manager to make sure they are aware of your desire to participate.

### **11.05 Construction Phase**

The Construction phase of the project is the last phase before Maintenance resumes responsibility for maintaining that section of highway. Although this phase is the last opportunity to make minor modifications to the project, changes outside the scope of the existing contract should be done in a separate contract. In special situations, changes outside the scope of the existing contract may be added, but require an approved Director's Order, concurrence of the Director's Order by the Chief, Division of Construction, and contractor agreement to a contract change order.

During this phase, there should be regular interaction between Construction staff and Maintenance staff. The Resident Engineer should be contacted prior to the start of work; Maintenance should be present at the pre- and post-construction meetings, and progress and pre-contract-acceptance reviews. During this phase, the Resident Engineer or the Construction Engineer is the contact for Caltrans. Maintenance staff shall not contact the contractor's staff directly.

#### **11.05.1 Pre-Construction Meeting**

Once a contractor has been selected, and usually before the contractor begins work on the project, the Resident Engineer will arrange a Pre-Construction Meeting between Caltrans and contractor staff. The Resident Engineer is required to invite the Area Superintendent and the Maintenance Supervisor to this meeting. The Maintenance Supervisor or the Maintenance Leadworker should make every effort to attend these meetings, since this will be the time to meet the contractor's representatives on the project, find out about the contractor's schedule, plans for completing the project, and discuss the need for maintaining pavement markings during the course of construction.

#### 11.05.2 Maintenance Within the Limits of the Project

On an existing State highway, Maintenance staff will continue to maintain such highway or portions of highway until the contractor takes possession of the highway within the project limits by erecting barricades, construction area signs, or breaking ground. Maintenance of these portions by Caltrans Maintenance staff will resume when the contractor is relieved from maintenance as provided in Section 7-1.15, Relief of Maintenance, of the Standard Specifications, or when the contract is accepted by the State as provided in Section 7-1.17, Acceptance of Contract, of the Standard Specifications.

When the project consists of widening the existing highway pavement or roadbed, the contractor may be restricted in their operations to a portion of the width of the roadway. In such cases, routine maintenance of the balance of the width shall continue to be the responsibility of Caltrans. However, any maintenance within the project limits should be performed in cooperation with the contractor's operations. The Resident Engineer should be notified of the routine maintenance operations within the project limits. The Resident Engineer in turn informs the contractor.

There might be sections of highway facilities that are outside of the actual areas of planned work where no alterations, modifications, or replacement to these facilities are to be done under contract. In such cases, maintenance is the responsibility of Maintenance staff, except for repair of damage due to the contractor's operations. Any State facilities that are damaged due to contractor's operations shall be repaired or replaced by the contractor at their expense.

Within the project limits, any damage caused by the traveling public to the State facilities that are being worked on under the project shall be fixed by the contractor. The contractor will be responsible to collect damage expenses from the responsible party except as provided in Section 7-1.16, "Contractor's Responsibility for the Work and Materials" of the Standard Specifications.

Every effort should be made by Maintenance staff to perform routine maintenance operations within the project limits before the contractor takes over the responsibility of the facility.

#### 11.05.3 Projects in Suspension

A project could be suspended from time to time, mostly during winter months. Before the project is placed under winter suspension, the Resident Engineer will make sure the project is prepared for winter suspension and prepare a written formal letter of suspension. Once suspended, Maintenance staff shall perform all required routine maintenance within the project limits. In the event a project is not suspended for the winter, snow plowing details still need to be worked out between the Resident Engineer and Maintenance forces.

#### 11.05.4 Final Inspection of the Project

When the project nears completion, the Resident Engineer or Permit Inspector should contact the Region Manager, Area Superintendent, or Maintenance Supervisor to arrange a final field review of the project. Should this review not happen, the Area Superintendent shall contact the Region Manager and the Resident Engineer or Permit Inspector to conduct a review of the project. This important review should be held when the project nears 90 percent completion. This is the period when a “punch list” is prepared to address any outstanding work.

The purpose of this joint review is to discuss:

- Operations of the facility.
- Features requiring special attention.
- The beginning date of any guarantee period and who to contact for warranty work.
- Manufacturer’s warranties and service instructions, if any.
- Work that may be required after contract acceptance.
- Features that should be handled differently on future projects. These features will be noted in a comprehensive letter from District Construction to District Design that will give suggestions for improving the design of future projects.

#### 11.05.5 Post-Construction Evaluation

After the acceptance of the project the Project Manager or the Resident Engineer should call for a Post-Construction Evaluation meeting. Maintenance forces should attend this meeting to provide input on their experiences with the project. This would also be a good occasion to make sure all warranty documents, service instructions, as-built plans and other documents are received from Construction. If a Post-Construction Evaluation meeting is not held, the Area Superintendent must meet with the Resident Engineer and make sure all the required documents are received.

### **11.06 Permit Projects**

Generally when projects are built under a permit, the Caltrans representative on the project will be the Permits Inspector. Caltrans staff will have minimum involvement in the Planning, Environmental, Right of Way, and Design Phases. However, prior to Caltrans approval of the permit, staff from various divisions will review the project design.

### **11.07 Resources**

As indicated at the beginning of this chapter, the project development process could take a long time and extensive involvement. The time spent on efforts related to a project could end up being substantial over the life of the project. Maintenance staff should talk to the Project Manager and get the appropriate Expenditure Authorization (EA) numbers to charge their time spent on the project. Maintenance staff should provide assistance to a project only when a valid EA is made available. This is not workload that should be absorbed by Maintenance funded resources.

# CHAPTER A

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## **A.00 Introduction**

This chapter contains information relevant to the “A” Family, Flexible Roadbed.

For “A” Family charging practice instructions, see Maintenance Manual Volume 2.

Refer to the “Maintenance Technical Advisory Guide” (MTAG) for complete description of materials, applications and recommended highway maintenance strategies for flexible pavements.

## **A.01 Definitions**

Maintenance of the traveled way covers the repair of both surface and base of the roadway within right of way lines that is for the movement of traffic. It includes the area between the inside of curbs where curbs exist, county road approaches, and city street intersections between right of way lines.

Maintenance work can be defined as that work, either by contract or by State forces, that preserves the riding qualities, safety characteristics, functional serviceability, and structural integrity of the facilities that comprise the roadways on the State highway system.

The Division of Maintenance has adopted the use of pavement preservation as a standard practice. Pavement preservation utilizes tools such as preventive, corrective, and routine highway maintenance, to keep the roadway in a safe condition, while improving the customer perception that roads are in a good state of repair.

Preventive Maintenance (PM1) is a planned treatment on a road in good condition that is intended to preserve the system, retard future deterioration, prolong the service life, and delay the need for rehabilitation. Corrective Maintenance (PM2) is a responsive treatment that is intended to temporarily correct a specific pavement distress, limited to \$60,000 unless approved by the District Director or his designee as Major Maintenance. Both PM1 and PM2 are performed by contract and State forces.

A flexible roadbed is a roadbed surfaced with asphaltic concrete (AC), or a portland concrete cement (PCC) pavement with a two (2) inch or more asphaltic concrete surfacing overlay. Oiled earth, gravel, and earth surfaces are also included under flexible roadbed.

**The roadbed is that portion of the roadway, including ramps and public road approaches, that extends from curb line to curb line or shoulder line to shoulder line, including dikes. Divided highways are considered to have two (2) roadbeds.**

## **A.02 Maintenance Levels**

The general objective of roadbed maintenance is to preserve roadbed facilities by applying pavement preservation practices that provide a roadway that is safe and in a good state of repair.

Maintenance of the roadbed covers the restoration and repair of both surface and underlying layers.

Typical items to be considered in roadbed maintenance are slippery pavement, cracking, raveling, corrugations, loss of lateral support from edge of pavement, wheel rutting, potholes, settlement, heave or distortion, bridge approach settlement, base failure, drip track erosion, and abrupt vertical surface differential.

Roadbed deficiencies that immediately affect safety should be given first priority in roadbed maintenance. Typical defects in this category are slippery pavement, raveling, rutting, excessive bridge approach settlement, potholes, and abrupt vertical variations.

Second priority should be given to the correction of roadbed defects having a long-range effect on riding quality and capital investment. Typical examples of defects in this category are pavement cracks and pavement and surfaced shoulder distress.

The following summaries provide typical considerations in roadbed maintenance and levels of service:

### **(A) Slippery Pavement**

- (1) Pavement surface texture is subject to adverse change as a result of aging, excess asphalt, wear, etc.
- (2) Routine surveillance of pavement texture should be made and suspected problem areas reported promptly.
- (3) Obvious slippery areas should be corrected to the extent feasible under the prevailing conditions. When additional corrective action is necessary, it should be initiated or scheduled promptly.
- (4) Suspected slippery areas should be promptly reported for further investigation.

**(B) Cracks**

- (1) Cracked pavement allows water and foreign material to enter the structural section, and may cause ultimate failure.
- (2) Individual cracks  $\frac{1}{4}$  inch wide or wider and any areas with extensive finer cracking should be repaired before the rainy season to protect the structural section.
- (3) Routine surveillance for Alligator cracking (ABC) should be made and corrective action taken.

**(C) Raveling**

- (1) Raveling is an indication of failure of the binder or aggregate. Once started, it may develop quite rapidly.
- (2) Raveling should be corrected before safety is impaired or extensive pavement loss occurs.

**(D) Corrugations**

- (1) Corrugations are repetitive distortions of asphaltic surfacing resulting in poor riding quality.
- (2) Corrugations should be corrected before safety is impaired or extensive pavement loss occurs.

**(E) Settlement, Heave and Distortion**

- (1) This type of roadbed defect often results in poor riding quality, and excessive impact loading of bridges and slabs. It does not always involve failure of structural section. Typical causes are fill-settlement, unstable cuts, expansive soils, and unconsolidated basement soil.
- (2) Settlement, heave, and distortion may not cause any problem at low speed, but would be objectionable at high speed.
- (3) Surface irregularities and vertical edges create a rough riding roadbed. Many irregularities are not as obvious to the driver at high speeds, as they are at low speeds.

- (4) An abrupt vertical differential between the traveled way and paved shoulder should be scheduled for repair when the riding quality is objectionable.
- (5) Corrections for surface irregularities should be scheduled when surface deviations reach 1½ inches in a length of 50 feet, or when the riding quality is objectionable.

**(F) Wheel Track Rutting**

- (1) Wheel track ruts have the undesirable effect of trapping water and may cause pavement deterioration.
- (2) Corrections should be scheduled when the groove exceeds one (1) inch in depth from a straight edge placed at right angles to the direction of travel, or when water is impounded.

**(G) Drip Track Erosion**

- (1) This is pavement erosion caused generally by crankcase drippings.
- (2) Correction should be scheduled when the resulting erosion exceeds ½ inch when water is impounded, or when evidence indicates the binder is ineffective.

**(H) Potholes**

- (1) Potholes are subject to rapid enlargement and may result in considerable pavement loss and objectionable ride.
- (2) Potholes should be repaired promptly.

**(I) Base Failures**

- (1) There are many degrees of base failure as evidenced by cracking or distortion in the surfacing. Many corrective measures may be applied, and ultimately the base may need replacement. Base failures considered here are those which require removal and replacement of the defective material.
- (2) When base material in localized areas becomes contaminated or broken to the extent that riding quality and structural integrity of the pavement cannot be restored by surface treatments, the defective base material should be removed and replaced. When necessary, temporary repairs should be made until permanent repairs can be scheduled.

**(J) Dikes and Berms**

- (1) Asphaltic concrete dikes and earth berms control roadbed runoff and protect slopes from erosion. When not maintained as built, extensive damage to the roadway may result.
- (2) Damaged dikes and berms, which will allow runoff to erode the roadway, should be repaired promptly or temporary repairs made until permanent repairs can be scheduled.
- (3) Damaged dikes and berms not falling under the above category should be routinely repaired in conjunction with other maintenance operations to minimize traffic disruption.
- (4) Asphaltic concrete dikes and penetration-treated berms in areas where asphaltic material is subject to rapid oxidation or freezing conditions should be inspected annually and sealed upon evidence of raveling, cracking, or other surface deterioration.

**A.03 Policy for Performing Roadbed Maintenance Work**

The Division of Maintenance should be dedicated to performing pavement preservation by both corrective and preventive applications; performing the “Right Work on the Right Road.”

Roadbed maintenance work can be accomplished by either contract or by State forces. This work is further subdivided into two broad categories; routine maintenance work, and Major Maintenance. When possible, the use of low cost strategies should be used to accomplish preventive maintenance.

It is the State's policy to contract out maintenance work that lends itself to this mode whether it is Major Maintenance, or routine maintenance. Work that is contracted out must be in full conformance with the relative provisions of the State Contract Act.

In exceptional situations, particularly on smaller projects, it may be impractical to contract for the work. Use of Maintenance crews is permissible under the following circumstances:

- (A) The project is so affected by conditions of site or existing structure as to make it impractical to define the details of the work with sufficient accuracy to permit competitive bidding.
- (B) The work is to be done at a remote location, and contractors do not appear interested in the project. However, in general, this should be determined by advertising for bids, or by documented contact with local contractors indicating they are not interested.
- (C) Where there is an urgent need for the work to start immediately, and it is not feasible to use one of the contracting procedures involving competitive bidding.

Maintenance funds can only be legally spent for maintenance work. Reconstruction, rehabilitation, and improvement work shall not be accomplished with Maintenance funds. Maintenance work can be defined as the preservation and keeping of rights of way, and each type of roadway, structure, safety convenience or device, planting, illumination equipment, and other facility, in a safe and usable condition to which it has been improved or constructed, but does not include reconstruction or other improvement.

### **Maintenance Work by State Forces**

Routine maintenance work is defined as maintenance work (at one or more locations) grouped together, where the distance between projects is at least two (2) miles, and total estimated project cost is less than \$60,000. Major Maintenance projects must meet the same criteria as routine maintenance work, except the estimated value of the project is over \$60,000. Within this limit, AC overlays are limited to 1/10<sup>th</sup> foot thickness, with additional allowance for filling depressions and wheel ruts.

All Major Maintenance by State forces shall be approved by the District Director or his/her designee, and submitted to the Headquarters Office of Roadway Maintenance with the district's annual highway maintenance pavement work plan. When Major Maintenance work is done by State forces, they are restricted to \$125,000 upper limit for all strategies. Routine maintenance work (under \$60,000) is usually accomplished by State forces, and does not require specific District Director approval.

The upper monetary limits specified above are necessary to clearly label them as maintenance work; not reconstruction, rehabilitation or improvement work. Major Maintenance work can be done by contract or State forces, provided the relative restrictions on State forces work are met.

Exceptions to the monetary limits require specific approval of the District Director and notification to Headquarters Maintenance.

If State forces costs have been underestimated, and it is necessary to exceed the estimate to complete the project, specific District Director approval is required, with notification to Headquarters Maintenance. There may be instances when the job scope will have to be reduced.

Routine maintenance requires the use of a Special Designation in the Integrated Maintenance Management System (IMMS). Major Maintenance requires the use of both a Special Designation and Project Code in (IMMS). See Maintenance Manual Volume 2 for instructions regarding the use of Special Designations and Project Codes.

### **Maintenance Performed by Contract**

When Major Maintenance is performed by contract, please refer to Major Maintenance Policy Directive “Work by Contract and Work by State Forces.”

Each year, the Division of Maintenance transmits to the districts, the allocation of funds for contract maintenance, including any specific restrictions that are included in these allocations. The districts shall submit their pavement programs to the Division of Maintenance for review and filing. Major Maintenance projects to be accomplished by State forces will be included in this program, but the districts have the responsibility to provide funding and staffing for this work. Additional projects or changes can be added to the program through the year with notification to the Division of Maintenance. A State Force “Major Maintenance Completion Report” shall be submitted no later than September 1<sup>st</sup> for Major Maintenance work accomplished in the previous year.

District Directors are responsible to see that roadbed maintenance work is carried out in conformance to the foregoing policies. The Division of Maintenance must be made aware of deviations or exceptions.

The following criteria comprise the Maintenance Program policy for the selection and use of the various strategies of maintenance that are available:

(A) Criteria for the Use of Chip Seals

The use of chip seals is a good strategy for preventive maintenance. Good candidates for chip seals should have less than 10% alligator “B” cracking and all ¼ inch cracks are tightly sealed. All alligator “B” cracking should be removed and replaced prior to chip sealing.

The use of chip seals for preventive and Major Maintenance work shall continue in conformance with the current standard which considers speed limits, average daily traffic (ADT), and the percentage of trucks. Considering the history of the chip sealing programs, the 30,000 ADT will continue to be the maximum ADT allowed when speed limits are 45 mph or higher. Please contact the Headquarters Office of Roadway Maintenance for details regarding the use of lightweight aggregates as an alternative for chip seals using conventional aggregates on higher ADT highways.

For emulsion chip seals at locations with ADTs of <5,000 per lane, districts may select a maximum chip size of 3/8 inches medium. The maximum size of chip for all higher ADT roads will be 5/16 inches.

For “Hot Applied” chip seals by contract (Polymer Modified Asphalt and Asphalt-Rubber Binders), 3/8 inch chips is the standard size chip to be used. For locations with ADTs of <5,000 per lane, districts may select a maximum chip size of ½ inch. Aggregate gradation for these seals shall be kept coarse to deter flushing problems caused by the high binder content and excessive fines in some designs. This is not a State forces strategy.

In areas where there is significant wheel rutting or there are irregularities (> ½ inch), corrective action should be taken to include either placement of an AC leveling course, or grinding and crack filling. The intent is to deter the flushing that often occurs in the wheel tracks or low spots caused by runoff of the binders from the higher spots to the depressions, and to prevent drainage problems. Provision for fog sealing or sanding the finished chip seal will be made if bleeding or chip loss is thought to be a problem. For all contracted chip seals, fog sealing and sanding (flush coats) are required.

It is recommended that cracks 1/4 inch or wider be filled or sealed before rainfall seasons, preferably during the fall and the spring when the cracks are partially opened allowing more sealant to penetrate. Cracks should be cleaned before filling or sealing by sweeping with a hard bristled broom or road sweeper to remove any dirt, debris, and/ or vegetation from the cracks. When moisture is present or suspected, the most effective crack sealing is performed by preparing the crack using hot compressed air (hot lance) immediately prior to application of filling or sealing material. All cracks should be squeegeed during filling and sealing (if product is left above the surface) to save materials, prevent road noise, improve ride quality, and prevent bleeding or masking through future surface treatments.

Additionally, it is recommended that crack fillers be placed several months before chip seals (depending on local climatic conditions) to assure sufficient cure time for various crack filling products. It has been proven that proper sealing or filling of cracks prior to placing surface treatments can greatly extend the life of roadways, retard future cracking, minimize secondary cracking, and reduce water infiltration.

Latex modifiers will be used in all emulsion chip seals. Continued experimentation is encouraged on chip seal projects for testing new products and techniques for increased flexibility, improved resistance to flushing, better chip adhesion, reduced windshield breakage, better crack filling and sealing, and longer life.

**(B) Criteria for the Use of Slurry Seals**

The use of slurry seals, as one of the preventive maintenance strategies, will be continued.

Polymer modifiers will be used in all slurry seals.

Preparatory work, including crack filling, pavement repair, and rut filling will be done in all cases prior to slurry sealing. Excessive overfilling with crack sealants shall be avoided to prevent fat spots in the slurry seal.

Slurry seal specifications have been written and are available for districts to use as a preventative maintenance strategy when 10 percent or less alligator "B" cracking (ABC) is present.

Several districts are placing slurry seals in areas that chip seals would not be a good choice due to high ADTs, e.g., intersections, signaled and stop areas, business areas, and areas that are heavily shaded, etc.

Slurry seals can be placed in areas with pavement and ambient temperatures are as low as 50 degrees F. Slurry seals are not to be placed at night, and by design are intended to be a single stone thick application.

When rut filling, night work, or colder temperatures restrict the use of a standard slurry seal, contact the TransLab regarding the use of micro surfacing. Micro surfacing uses a chemical break and may be placed in cooler conditions as low as 40 degrees F.

**(C) Paved Shoulder Sealing**

The normal treatments for paved shoulders when seal coats are being placed is as follows:

As a minimum, paved shoulders will receive a rejuvenating agent, sand seal, or fog seal.

If the conditions of the paved shoulder is poor, and has already had several applications of fog seal or rejuvenating agent, the shoulder will receive a chip seal or a slurry seal the same as the traveled way. When applying a slurry seal, consider the use of a Type II or a Type III to prevent water from being trapped at the edge line.

In those situations where traffic, weather, or other special conditions require the application of open graded asphalt concrete, the application may be extended to the paved shoulder when it is four (4) feet or less in width. When the shoulder is four (4) feet wide or more, the open graded asphalt concrete shall be placed one (1) foot beyond the traveled way edge. The outside six (6) inches of the open graded asphalt concrete will be hot rolled immediately after being placed so as to produce a taper from  $\frac{3}{4}$  inches thick to nearly nothing.

Pavement overlays one (1) inch thick or greater should cover the entire shoulder, regardless of the width.

#### **A.04 Surface Types**

The traveled way of the State highway system consists of two basic types for maintenance purposes:

**(A) Flexible Type Surfacing (Flexible Roadbed)**

Includes all highways with asphalt surfacing and portland concrete cement with asphaltic concrete surfacing overlay of two (2) inches or more.

Oiled earth, gravel, and earth surfaces are also included as flexible type surfacing.

Specifically, flexible pavement is composed of the following types as listed in the California State Highway Log:

Surface Types (Flexible)	
CODE	TYPE
H	With base and surface thickness 7 inches or more
M	With base and surface less than 7 inches and Oiled Gravel
O	Oiled Earth, Gravel
E	Earth

**(B) Rigid Type Surfacing (Rigid Roadbed).**

"A" Family covers maintenance of flexible roadbeds and "B" Family covers rigid roadbeds. Various phases of work involved in these two Families are described in this chapter and in Chapter "B" of this manual.

### **A.05    Types of Flexible Roadbed Failures**

Flexible roadbed may fail by any one or a combination of the following:

- (A) Slippery surface often caused by excess asphalt combined with dense surface texture.
- (B) Cracking, often due to either brittleness of the asphalt mix, movement in the base, or contraction and expansion due to temperature changes.
- (C) Raveling is generally due to a dry mix or oxidation. However, an excessive amount of moisture can contribute to raveling by washing away the asphalt cement. Freeze-thaw cycles also contribute to raveling.
- (D) Distortion is generally from instability of the mixture, an inadequate base, or both. Distortion will often result when a mixture is too “fat”, meaning there is an excess of asphalt.
- (E) Erosion, due to solvent liquids from an outside source dripping on the pavement surface. This condition is most often caused by crankcase drippings, particularly on ramps at boulevard stop bars.
- (F) Surface breaks are often a result of a lack of base or support under the pavement surface.
- (G) Stripping is closely related to raveling. The cause of stripping is water separating the asphalt cement from the aggregate.
- (H) Oiled gravel or earth surface failures are generally the result of traffic loads and wind and weather conditions.

### **A.06 Stockpile Materials for Patching Bituminous Surfacing**

Materials for pre-mix, medium-cured (MC) or slow-cured (SC), should be tested by the District Laboratory prior to use, if practical. Premix should be stockpiled at the Maintenance station or in rural areas. Storage should be at convenient locations and accessible at all times. Do not stockpile on private property unless necessary written authority is obtained. Avoid locations offering a traffic hazard, where drainage may be disturbed, or where storm water flows can be affected. Stockpiles should be as inconspicuously placed as possible. Keep stockpiles well squared off and free from weed growth, using herbicides if necessary. Place 'State Property' signs on each stockpile and use appropriate stormwater "Best Management Practices."

Materials required for bituminous surface patching are usually obtainable from the following sources:

- (A) Commercial hot-plants, where plant mix material can be obtained directly from the plant in State-owned or rented trucks for use on the highway, or for stockpiling for future use. Where sections of highway are some distance from a hot-plant, stockpiling effects a substantial saving of time by providing asphalt plant mix material where and when it is needed.
- (B) Local material from pits that have been tested by the District Laboratory, or are otherwise proven suitable for use. These materials can be either mixed at the pit site or hauled to a mixing table for processing. A motor grader is the most commonly used road mixing equipment.

Liquid asphalt for premix may be an MC250, MC800, MC3000, SC250, SC800, or SC3000. The MC type asphalt is a medium curing product, with a solvent similar to kerosene. The SC type is slow curing because its solvent is somewhat like a heavy fuel oil.

Generally speaking, the SC oils are used in the hot desert climates, and MC oils are used in the more moderate climates. In many cases, local experiences will dictate the type of oil to be used in manufacturing stockpiled materials for patching bituminous surfacing. Information contained in the Asphalt Institute's various publications can be of some value.

For environmental reasons, MC liquid asphalt is not allowed in some air basins. The cutbacks used for this grade of asphalt give off emissions that are not permitted by the Air Resources Board in those basins. The County Air Resources Board can provide information regarding local requirements.

### **A.07 Asphalt Concrete Pavement**

Asphalt concrete pavement consists of a mixture of mineral aggregate and bituminous binder (asphalt cement) mixed and spread in accordance with specifications. The gradation of the aggregates vary because of the need for meeting traffic requirements, and the availability of aggregate material in any geographical location.

Asphalts are generally grouped within four classifications, including:

- (1) Paving asphalt;
- (2) MC (Medium Curing) liquid asphalt;
- (3) SC (Slow Curing) liquid asphalt; and
- (4) Various types of emulsions.

Refer to Sections 92, 93, and 94 of the Standard Specifications for complete definitions and descriptions of asphalts and emulsions.

Asphalt concrete mixtures are generally densely graded. This means that the mixture contains very few voids. In some instances, open graded mixtures, that is mixtures that contain more voids than dense graded mixtures, are used for pavement wearing surfaces. These mixtures have the advantage of draining surface water through the void areas. However, they are somewhat susceptible to damage under freeze-thaw conditions. In addition, asphalt-rubber gap graded mixes are being used throughout the state.

For open graded asphalt concrete, the bituminous binder for mixing with mineral aggregate may be paving asphalt Grade AR4000 or AR8000 conforming to the Standard Specifications. Climate and experience will indicate which paving asphalt is best for any particular location. In addition, polymer modified and asphalt-rubber binders are available to use for open graded AC.

Difficulties are encountered in hauling open-graded hot asphalt concrete a long distance from a hot-plant, as the exterior of the mass tends to chill and the asphalt in the mix drains to the bottom of the truck. This results in an excess of the exterior asphalt in that portion of the load. This also requires frequent cleaning of the truck beds due to the accumulated asphalt.

Best results can be obtained in hauling and spreading open graded asphalt concrete by reducing the mixing temperatures of both the paving asphalt and the mineral aggregate, as indicated in Section 39 of the Standard Specifications.

Hot material spreads very easily through the spreader box. However, when the mass cools, due to weather or long hauls, considerable difficulty is experienced in securing a satisfactory spread. As a rule, a 30-mile haul is usually considered the maximum distance that a hot mix can be satisfactorily hauled.

For the technical specifications for asphaltic concrete used in the Department's construction work, refer to the Asphalt Concrete Section of the Standard Specifications.

#### **A.08 Surface Repairs of Oiled Earth, Gravel or Earth Surfaces**

Maintenance of oiled earth, gravel, or earth surfaces whether in the desert, valley or mountains, is similar and may be done as follows:

- (A) Maintain a crown on the traveled way. This is essential for adequate drainage transverse to the centerline.
- (B) Always attempt to improve drainage of all ditches and culvert outlets.
- (C) Grade protecting dikes or berms on the shoulders of all fill sections to prevent formation of gullies on slopes. Also provide outlets to discharge pipes to prevent erosion.
- (D) Correct sub-base drainage when surface rolls or distorts. Use perforated metal pipe or rock drains. Locate all depressions during or following a rain and fill with good material. Because of potential cloudbursts in desert areas, numerous drainage outlets must be provided to prevent ponding or scour.
- (E) During regular maintenance grading, always attempt to improve the superelevation in curves.
- (F) If possible, grade after a rain and compact the surface under traffic.
- (G) Dry weather grading may be necessary to provide a smooth surface. Use caution not to cut too deeply or have excess loose material on the surface. Do not leave a windrow of material on the travelway overnight.

Corrugations in an earth or gravel surface are usually caused by lack of binder in a surface composed principally of rounded coarse aggregate, or a surface predominantly composed of fine material. This condition should be relieved by blading a sufficient depth below the surface to remove the corrugations from the travelway.

Another method to remove corrugations is by the addition of material with uniform gradation so that when it is compacted, it will retain its shape under normal traffic conditions. Blade the center area first, working outward toward the edges. Potholes should be filled with select material prior to the grading operations.

### **A.09 Base Repairs**

Prior to making surface repairs on any asphalt concrete pavement, determine whether or not the damage was the result of a base failure. If a base failure is evident, decide whether or not the base should be repaired. A surface repair will frequently add sufficient strength to the pavement structural section so that a base repair is not necessary.

Remove all broken material when a base repair is made. Inspect the soil or other material on which the base was laid. Replace poor material as required. Reconstruct the base, preferably with base type asphalt concrete. If this is not practical, reconstruct using whatever good materials may be available. Leave room on the top of the base patch in a suitable thickness to receive the wearing course asphalt pavement.

### **A.10 Surface Repairs of Flexible Pavement**

All AC used in the "A" Family will require the use of Special Designation MMRPAVER, MMCTPAVER, MMGRIND, MMAC or MMRUB. Please refer to the Maintenance Manual Volume 2.

Surface repairs to flexible pavement vary from very shallow patches tight bladed onto the old surface with a motor grader, to pothole patching, to a Major Maintenance overlay. Surface maintenance is not to be confused with resurfacing or reconstruction of an asphalt concrete highway.

Generally, reconstruction or resurfacing will cover several miles of highway. The good portions as well as the poor portions are reconstructed or resurfaced. Major Maintenance patching should be done only where the need exists, and where a major patch will take the place of a series of small patches.

Asphalt pavement, whether pre-mix or asphalt concrete, will weigh on the average 12 pounds per one (1) square foot and one (1) inch thick. Good rule of thumb is ***1 x w x 0.006 = tons needed.***

### **A.11 Pothole and Other Small Patches**

Remove all loose material prior to patching potholes. Shape the area evenly with sloping sides to the depth of the patch. The bottom and sides should be primed. For priming, use either liquid asphalt or an emulsified asphalt.

Premix material is then placed in the hole and compacted. Make allowance for compaction that will permit the finished surface of the patch to be flush or just slightly above the surrounding surface. As a general rule, premix asphalt paving material will compact  $\frac{1}{4}$  inch for each one (1) inch of loosely placed thickness.

Small patches may be laid directly on top of asphaltic concrete surfaces in some instances.

Before this is done, the surface to be patched must be clean and free of any foreign substances. Apply a tack coat of emulsion to the area to be patched prior to applying the patch material.

Small patches may be laid by hand. On larger patches, it may be more effective to use a motor grader or an asphalt concrete spreading box. Larger patches should be thoroughly rolled. All patches should have squared ends and straight sides for a properly finished appearance.

During periods of cold and inclement weather, potholes can be patched with patented special mixes. The special mixes do not require that the pothole be dry, nor is a prime necessary. Though more expensive than a normal stockpiled premix material, special mixes reduce patching costs because they stay in the potholes much longer.

### **A.12 Extensive Surface Repairs and Major Maintenance Blankets**

A Maintenance Blanket may be used to make the necessary repairs when pavement failure becomes extensive, over and beyond that requiring pothole or other small patches. Maintenance Blankets should be planned in the district's Major Maintenance Program. See this Section A.03 for policy on Major Maintenance projects with MM Special Designation.

The surface to receive a blanket should be carefully broomed of all loose material. Prior to placing the blanket, the surface should be tack coated with an asphalt emulsion of RS, CRS, SS, CSS grade or PASS. The rate of application should be enough to wet the surface of the old pavement and provide a bond between the new surfacing material and the old one.

### **A.13 Surface Corrugations**

Corrugations and shoving usually occur in asphalt layers that lack stability. Lack of stability may be caused by a mixture that is too rich in asphalt, has too high a proportion of fine aggregate, has coarse or fine aggregate which is too round or too smooth textured, or has asphalt cement which is too soft. It may also be due to excessive moisture, contamination due to oil spillage, or lack of aeration when placing mixes using emulsified or cutback asphalts.

If the corrugated pavement has an aggregate base with a thin surface treatment, a satisfactory corrective measure is to scarify the surface, mix it with the base, and re-compact the mixture before resurfacing.

If the pavement has more than two (2) inches of asphalt surfacing and base, shallow corrugations can be removed with a pavement-planing machine. This is followed with a seal coat or plant-mixed surface.

Shoved areas must be removed and patched for effective repair.

### **A.14 Heat Treatment**

In some instances it may be advisable to remove the surface course of asphalt concrete pavement. In other cases, it may be advisable to reduce the quantity of asphalt cement in a pavement surface.

A pavement-planing machine, such as a heater-planer, will accomplish this work by softening the surface so that it may be bladed into a windrow by a motor grader. Heater-planers must be used in accordance with local air pollution control laws or policy.

After removal of a thin asphaltic layer or an asphaltic film with a heater-planer, the remaining surface may be left as planed if it is in good condition. However, in most cases a new asphalt concrete surface or a seal coat should be applied after a heater-planer job.

Another treatment that should be considered in rural areas to remove excess surface asphalt is the use of an agricultural weed burner. This process has been used successfully, and consists of making one pass over the pavement at about two (2) to three (3) miles per hour.

This is a very economical process to improve skid resistance in appropriate situations. It also must be cleared for air pollution control.

### **A.15 Seal Coats**

Seal coats may be required on asphalt pavement when the pavement shows signs of: (a) raveling or erosion, (b) oxidation, (c) permeable surface, or (d) slipperiness.

A continuous seal should be considered when raveling and checking becomes general or the surface of an asphalt pavement becomes permeable to water. Refer to the Standard Specifications for detailed information on seals. The amount and type of asphalt binder and size of screening selected should be such that maximum temperatures will not cause excessive bleeding. Upon completion, the newly sealed surface should be inspected to determine that it has a nonskid surface equal or superior to the surface it replaced.

### **A.16 Preparation Prior to Applying Seal Coats**

Prior to, applying a seal coat, correct base failures and corrugated or distorted surface conditions. Apply seals only on a dry surface (except for fog seal). Sweep the surface clean with power brooms, supplemented by hand brooming.

Level depressions with premix. This work should be done far enough in advance of the seal coat application to allow for complete curing of the premix. If this is not done, the asphalt will penetrate the uncured premix and will not hold the screenings. Rich spots in the surface to be sealed should be removed by diskings, heater-planer, or scarifying and re-mixing before the seal is placed.

### **A.17 Types of Seal Coats**

Seal coats commonly used in maintenance work are:

- (A) Fog seals
- (B) Sand seals
- (C) Scrub Seals
- (D) Chip seals
- (E) Slurry seals

The type of seal coat required is usually dictated by field conditions. The five types of seal coats and their applications are described below.

- (A) Fog seals are "... a light spray application of diluted asphalt emulsion used primarily to seal an existing asphalt surface to reduce raveling and enrich dry and weathered surfaces." Typical application rate for the diluted emulsion delivered to job site, equal amount of water to the diluted emulsion, is a one (1) to one (1) ratio, and is applied at the rate of 0.10 to 0.125 gallons per square yard (equal amount of emulsion to water ratio) applied at the rate of 1/8 to 1/10 gallon per square yard. No cover material is to be applied.
- (B) Sand seals consist of liquid asphalt applied at a rate per square yard dictated by the condition of surfacing. Cover material can be obtained by using sand from commercial sources or screened material from local pits or streambed which has been tested by the District Laboratory or otherwise found suitable for use. Do not use sand that contains clay or deleterious material.
- (C) Application of a polymer modified asphalt to the pavement surface followed by the broom scrubbing of the asphalt into cracks and voids. This is followed by the application of an even coat of sand or small aggregate, and a second brooming of the aggregate and asphalt mixture. This seal is then rolled with a pneumatic tire roller.
- (D) Chip seals consist, in general, of spreading high viscosity asphaltic emulsion with additives followed by spreading rock screenings (chips) in the appropriate rates of application in accordance with the section on seal coats to be found in the Standard Specifications. Sometimes paving grade asphalts with special additives are used in lieu of emulsion for the binder. A flush coat should follow all chip seals.

On seal coat work, the spread rate of emulsion and weight of cover material required will vary somewhat based on the condition of the surface covered, temperature, and type of screenings used.

- (E) Slurry seal consists of an application of a mixture of mixing-type asphaltic emulsion, sometimes with additives, mineral aggregate and water, proportioned, and mixed and spread on a pavement free of dirt and loose gravel. For complete specifications on slurry seal consult the Standard Specifications.

#### **A.17.01      Pavement Rejuvenator**

A pavement rejuvenator treatment consists of an application of a rejuvenator material in a procedure similar to a fog seal. This treatment is most effective on dry, porous pavements. The material should be applied well in advance of the fall rains, if possible. If it is not possible to apply the material in advance of the fall rains, it should be applied after the rains in the spring.

It is important to run permeability tests on the pavement prior to application of pavement rejuvenator to determine the proper application rate according to the manufacturer's recommendation. The application rate should be based on test results at the most-dense location. If complete penetration of the surface does not occur, apply sand to prevent slippery conditions. Perform tests within one (1) week after the application to check the pavement surface.

### **A.18 Spreading Cover Material Over Seal Coats**

On seal coats where either emulsified asphalt or hot oils are used, do not spread the asphalt too far in advance. Make certain that the cover material is placed at the most opportune time to obtain adhesion.

Mechanical spreaders for sand or screening (chip) cover should be used for a uniform cover and to eliminate surplus cover that is usually lost.

When sand seals are placed, thoroughly broom the area with drag brooms to properly cover all blank spots and provide a uniform texture.

When screenings (chips) are used for cover, one or more power rollers should be used immediately behind the trucks spreading the screenings (chips) to provide initial rolling.

A drag broom should not be used on screening (chip) seal coats, because this could displace or overturn the screenings.

Traffic may be routed over newly laid screenings after they have been rolled but must be restricted to a very slow speed and should be under control until screenings are thoroughly set.

Traffic moving at high speeds on screening seal coat that are not thoroughly set often causes displacement of screenings from the surface, resulting in an over-oiled section which "bleeds" in warm weather. Loose aggregate should be removed by brooming when the asphalt has cured. The first brooming should take place at the end of the first day, just prior to the time when traffic controls are removed for the day. Loose material will have a tendency to loosen additional chip particles under the tires of fast traffic.

### **A.19 Flexible Pavement Joint and Crack Sealing**

Flexible pavement is susceptible to cracking. Cracks are generally attributable to the lack of base support, volume change in the asphalt mix because of temperature changes, and drying of the asphaltic concrete mix. Cracks should be repaired to prevent the entrance of moisture into the sub-grade.

Cracks may be filled with emulsion, emulsion and rejuvenator mixture, rubber asphalt, or liquid asphalt. Wider cracks may be filled with special asphalt combinations or heavier bodied asphalt material with additives. When using emulsion, light grade liquid asphalts, or asphalt rejuvenators for crack repairs, fine sand should be mixed with the liquid or applied to the surface of the crack after it has been filled.

Cracks should be cleaned prior to filling. A stiff broom may be used for this purpose. Compressed air may also be used, if available. A gouge-type tool or mechanical router can also be used for crack cleaning.

Small cracks, such as alligator-type cracking, should be repaired by tacking a blocked-out area and applying chips or other similar material. A thin patch of hot plant mix may also accomplish the same purpose. When using these methods, the seal or patch should be blocked out to give a uniform rectangular appearance.

Slippage cracks are caused by the lack of a good bond between the pavement's surfaced layer and the course beneath. The only proper way to permanently repair a slippage crack is to remove the surface layer to where good bond between the layers is found, then patch the area with plant mixed asphalt concrete.

#### **A.20 Work on Asphalt Shoulders**

Due to the hazards of traffic, work on paved asphalt shoulders should be confined to one side of the highway at a time. Workers shall be given protection while working on paved shoulders as outlined in Chapter “8” of this manual.

#### **A.21 Road Approaches to Public Roads**

City or county authorities must obtain permits prior to doing any work on a road approach within the State highway right of way.

The following instructions apply to other road approaches to public roads:

- (A) Where State highways connect with county roads and city streets at grade, Caltrans forces will maintain the roadway to the full width of the right of way.
- (B) Where the intersections of State highways with county roads and city streets are separated by structures, maintenance is performed as provided in the Maintenance Agreement with the local authorities.
- (C) When a new road or street approach is to be constructed by city or county authorities connecting with a State highway, it shall be constructed or improved to meet the standards required for the type and volume of traffic expected.

All public road approaches should be maintained flush with the adjacent shoulder.

Maintenance of freeway interchanges will be in accordance with the Freeway Maintenance Agreements. Superintendents should be furnished a layout sketch showing in detail those portions of the intersection to be maintained by the State.

## **A.22 Non-Motorized Travelers on State Highways**

Non-motorized travel (bicycling/walking) is permitted on State highways with the following exceptions: In general, pedestrians are prohibited from freeways; bicyclists are prohibited from most freeways, but permitted on segments where there is no alternate route parallel to the freeway. Highway improvements and maintenance operations on facilities where non-motorized travel is permitted shall consider the needs and safety of bicyclists and pedestrians.

The following considerations shall be taken into account when planning highway improvements:

- (A) In the placement of maintenance blankets, paved shoulders shall be overlaid, as well as traffic lanes, to prevent creation of a longitudinal step along the right-hand portion of the roadway.
- (B) In the application of seal coats, if the roadway is 26 feet or less in width, the entire surface should be sealed. For wider roadways, the normal procedure is to seal only the traffic lanes, 24 feet. However, if the shoulders need sealing, they should be sealed full width to provide a uniform surface.
- (C) Routine roadway maintenance (e.g., repairing deteriorated pavement, roadway excavations, etc.) should be done in such a manner that a uniform surface, free of obstructions, is maintained across the full paved width of roadways, including shoulders. If the right-hand portion of roadways is not properly maintained, bicyclists and pedestrians will find it necessary to share the traffic lanes with motor vehicles.

# CHAPTER B

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Original signed by

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Division of Maintenance

## **B.00 Introduction**

The information contained in this chapter is covered by the "B" Family, Rigid Roadbed.

Detailed charging practice instructions for the "B" Family are contained in Maintenance Manual Volume 2.

## **B.01 Definitions**

A rigid roadbed is a roadbed surfaced with portland concrete cement (PCC). Portland concrete cement pavement surfaced with less than two (2) inches of asphaltic concrete (AC) is also included under rigid roadbed.

The roadbed is that portion of the roadway, including ramps and public road approaches, that extends from curb line to curb line or shoulder line to shoulder line, including dikes. Divided highways are considered to have two roadbeds.

## **B.02 Maintenance Levels**

The general objective of roadbed maintenance is to preserve roadbed facilities by applying pavement preservation practices that provide a roadway that is safe and in a good state of repair. Maintenance of the roadbed covers the restoration and repair of both surface and underlying layers.

Typical items to be considered in roadbed maintenance are slippery pavement, proper drainage, cracking, shoulder dropoff, slab warp, spalling, slab settlement, heave or distortion, bridge approach settlement, base failure, joint separation, checking, joint sealing, and abrupt vertical surface differential.

Roadbed deficiencies that immediately affect safety should be given first priority in roadbed maintenance. Typical defects in this category are slippery pavement, excessive bridge approach slab settlement, and abrupt vertical variations..

Second priority should be given to the correction of roadbed defects having a long-range effect on riding quality and capital investment. Typical examples of defects in this category are pavement cracks, pavement and surfaced shoulder distress, and spalls.

The following summaries identify typical examples of defects and required levels of maintenance.

**(A) Slippery Pavement**

Pavement surface texture is subject to adverse change as a result of aging, wear, etc. Routine surveillance of pavement texture should be made and suspected problem areas reported promptly.

Obvious slippery areas should be corrected to the extent feasible under the prevailing conditions. When additional corrective action is necessary, it should be initiated or scheduled promptly.

Suspected slippery areas should be promptly reported for further investigation.

**(B) Cracks**

Cracked pavement allows water and foreign material to enter the structural section and may cause ultimate failure.

Individual cracks 1/4-inch wide or wider and any other areas with extensive finer cracking should be repaired before the rainy season to protect the structural section.

**(C) Settlement, Heave and Distortion**

This type of roadbed defect often results in poor riding quality and excessive impact loading of bridges and slabs. It does not always involve failure of the structural section. Typical causes are fill-settlement, unstable cuts, expansive soils, and unconsolidated basement soil. This type of defect may not cause any problem at low speed but would be objectionable at high speed.

Surface irregularities and vertical edges create a rough riding quality. Many surface variations are not as obvious to the driver at high speeds as they are at low speeds.

Correction for surface irregularities should be scheduled when the surface deviation reaches 1½ inches in a length of 50 feet, or when the riding quality is objectionable.

Differential changes in elevation of individual PCC pavement slabs also result in poor rideability and accelerate pavement deterioration due to increased impact loading. When surface deviations exceed ½ inch between adjacent slabs, corrections should be scheduled. A repair should be scheduled when an abrupt vertical differential between the traveled way and paved shoulder results in poor riding quality.

Bridge approach slab settlement is a problem requiring routine surveillance. A void often exists under a PCC approach slab long before the slab settles. Slab settlement can often be prevented by early detection and filling of voids.

An exploration should be made within one (1) year after construction to assist in early detection of voids under bridge approach slabs. Voids that are discovered should be filled. Since some voids occur several years after construction, a continuing visual inspection is necessary for signs of voids under approach slabs such as springiness or separations at the edge of PCC pavement.

**(D) Spalling**

A transverse spall in PCC pavement that exceeds four (4) inches in length in the direction of travel or one that adversely affects comfort should be repaired. Longitudinal spalls that adversely affect riding quality should be repaired.

**(E) Joint Separation**

Joint separation in PCC pavement allows water to reach underlying structural layers. This often results in a rocking slab with subsequent pumping of underlying materials through the joint and ultimate slab failure.

Joint separation between PCC pavement and adjacent AC shoulders is detrimental as it allows surface runoff to penetrate the structural section and often causes shoulder failure. In addition, it provides space for growth of objectionable vegetation.

Joints in PCC pavement and shoulder joint separation between PCC pavements and AC shoulders that exceed 1/8 inch should be filled.

**(F) Dikes and Berms**

Asphaltic concrete dikes and earth berms control roadbed runoff, and protect slopes from erosion. Extensive damage to the roadway may result when these are not maintained as built.

Damaged dikes and berms which will allow runoff to erode the roadway should be repaired promptly, or temporary repairs should be made until permanent repairs can be scheduled.

Damaged dikes and berms not falling under the above category should be routinely repaired in conjunction with other maintenance operations to minimize traffic disruption.

Asphaltic concrete dikes and penetration-treated berms in areas where asphaltic material is subject to rapid oxidation or freezing conditions should be inspected annually and sealed upon evidence of raveling, cracking, or other surface deterioration.

### **B.03 Definition of Traveled Way**

The traveled way includes both the surface and the base of the roadway within right of way lines that is for the movement of vehicles. It includes the area between the inside of curbs where curbs exist, county road approaches, and city street intersections between right of way lines.

### **B.04 Policy for Performing Roadbed Maintenance Work**

Refer to Chapter “A”, Section A.03 for the policy for performing roadbed maintenance work.

### **B.05 Surface Types**

Rigid Type Surfacing includes all portland cement concrete (PCC) pavement including concrete pavement with less than two (2) inches of asphaltic concrete (AC) surfacing overlay.

As listed in the California State Highway Log, the following surface is rigid pavement:

Surface Types (Rigid)	
CODE	TYPE
ST	Surface Type
C	Concrete (less than 2 inches AC surface)

### **B.06 Types of Rigid Roadbed Failures**

Rigid Roadbed will fail by any one or a combination of the following:

- (A) Cracking may be due to either failure of the base or temperature expansion and contraction.
- (B) Slab sinking is caused by base failure or movement of the earth mass beneath the pavement structure.
- (C) Raised joints are generally caused by curling of pavement slabs or faulting at the joints.
- (D) Faulting refers to vertical displacement of concrete pavement slabs at joints.
- (E) Spalled joints are caused by a joint surface edge breaking, resulting in a hole in the pavement surface at a joint.
- (F) Surface spalling may be caused by freeze thaw cycles, or by the continued use of metal coming in contact with the pavement surface, such as vehicles using tire chains.

### **B.07 Rigid Pavement Repairs to Portland Cement Concrete Pavement Using Asphalt Materials**

Asphalt plant mixed material may be used for many surface repairs to rigid pavement. They will generally be used in cases of sunken slabs or extensive slab breakage. Before making any asphalt repairs to rigid pavements, the surface must be well cleaned and tacked with a paving asphalt or emulsion to ensure a good bond between the PCC surface and the asphalt concrete or pre-mix overlay.

When making asphalt concrete repairs to PCC, base repairs are very seldom necessary. It is only in an extreme case such as pavement blowups that a PCC pavement should be replaced in its entirety with an asphalt type pavement. Because of the time required for PCC curing, and consequently, interference with traffic, small areas of broken concrete that must be replaced are usually replaced with asphalt material.

### **B.08 Portland Cement Concrete Patching with Concrete**

Where it is not practical to repair a concrete surface with asphalt material, permanent repairs should be made by removing broken sections and replacing them with PCC. High early strength cement should be used. In some instances, 1½ percent of calcium chloride may be added to hasten the setting time of the patch. There are also several proprietary rapid-setting products available for patching.

Where fresh concrete is to be placed against old concrete, and when spalled joints are being repaired, a more effective joint can be obtained by using an adhesive consisting of modified epoxy resin applied to the edges of the old concrete immediately before the fresh concrete is placed. In repairing PCC pavement with new concrete, allow ample time to permit the new concrete to set prior to opening the section to traffic. With high early strength concrete, this will generally be 24 hours.

### **B.09 Portland Cement Concrete Joint and Crack Seal**

Generally, sawed joints in PCC pavements should be filled. Contact the District Material Laboratory if a faulting condition develops at transverse joints. The Lab will study the condition and make recommendations. Any random cracks should be filled before the winter rains.

Cracks or joints in PCC pavements may be filled with any of a variety of commercially available crack fillers.

Do not overfill cracks, as a build-up of filled material results in bumps that are noticeable to traffic.

Joints between the concrete and asphalt shoulders are generally filled with a mixture of emulsion and rejuvenator, and topped off with sand.

Refer to the "Flexible Pavement Joint and Crack Sealing" section in Chapter "A" of this manual, as this work is similar whether the pavement is flexible or rigid.

### **B.10 Portland Cement Concrete Base Reinforcement by Mudjacking**

Mudjacking may be used to re-establish the base under PCC slabs without removing the slabs. In addition to base reinforcement, sunken slabs may sometimes be raised to grade by this method. Mudjacking literally replaces lost or sunken base material by pumping a portland cement grout underneath the slab. The grout is pumped through holes drilled into the slab at required intervals. Special pumping equipment is needed for this purpose.

The material used in mudjacking should have a low shrinkage factor, good strength, and the ability to flow through the equipment and spread under the pavement. A grout consisting of 1 part portland cement, 3 parts pozzolan, and 1.4 to 2.4 parts water should be used.

Mudjacking is a special process and is generally performed by specialized crews.

### **B.11 Portland Cement Concrete Slab Base Reinforcement by Subsealing**

Cavities under sunken or moving slabs may be filled by subsealing with asphalt. This practice has not been used often in past years. However, if it is determined that this method should be used, consult the district's Materials Lab for specification and advice regarding this maintenance practice.

### **B.12 Portland Cement Concrete Grinding**

Irregular surfaces in portland cement concrete pavement are often corrected by grinding. This works well for correcting the riding qualities of a pavement that has faulted. Grinding projects are generally done by contract. When it is felt that grinding is the solution to correcting irregularities in concrete pavement surfacing, the problem should be brought to the attention of the Deputy District Director, Maintenance. Extensive grinding work is generally considered as reconstruction, and is not a maintenance charge; however, isolated small areas may be classified as maintenance.

### **B.13 Work on Asphalt Shoulders**

Due to the hazards of traffic, work on paved asphalt shoulders should be confined to one side of the highway at a time. Workers shall be given protection while working on paved shoulders as outlined in Chapter "8" of this manual.

**B.14 Road Approaches to Public Roads**

Refer to Chapter “A”, Section A.21 of this manual for definition of Road Approaches to Public Roads.

**B.15 Non-Motorized Travelers on State Highways**

Refer to Chapter “A”, Section A.22 of this manual, “Non-Motorized Travelers on State Highways”, for more detailed information about maintenance procedures on highways where non-motorized travel is permitted.

# CHAPTER C2

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Original signed by  
Sheree Edwards  
Office of Roadside  
Division of Maintenance

## **C2.00 Introduction**

This chapter is divided into three sections. Section I provides controlling legal requirements, background regarding the development of the Caltrans Vegetation Control Program, a description of that policy, and requirements for district implementation. Section 1 provides guidance for vegetation control of native plants in non-landscaped areas. Section 3 includes legal requirements and directions for the use of pesticides.

There are four appendices to this chapter: a list of approved herbicides, a list of approved adjuvants, a form used for spray equipment being repaired, and illustrations of pruning methods.

Refer to the Maintenance Manual, Volume 2 for planning, scheduling, administrative controls, and charging practices that apply to this program.

## **SECTION 1: Legal Requirements, Background, and Policy**

### **C2.01 Laws Regarding the Care of Vegetation in California**

(A) The Penal Code, Section 384(a):

This section of the Penal Code relates "... to the protection of native trees, shrubs, ferns, herbs, bulbs, cacti, flowers, huckleberry, or redwood greens." This law prohibits negligence including cutting and removing plants growing upon State or county highway right of ways, public land, and land not owned by persons performing such acts without written permission from the owners.

(B) Streets and Highways Code, Section 730.5

This section relates to the destruction of trees and shrubs on State highways. It allows the State of California to recover \$10,000 for each tree damaged and \$1,000 for each shrub damaged.

(C) Streets and Highways Code, Section 1495

Section 1495 relates to injury to trees on highways.

(D) Streets and Highways Code, Section 670

This section relates to removal or planting of trees and shrubs on State highways.

(E) The California Environmental Quality Act (CEQA)

This law requires that any project that has a significant impact on the environment requires an Environmental Impact Report (EIR). The annual Vegetation Control Plan may be considered to be a project under CEQA.

In preparing an EIR, alternatives and mitigation measures must be considered. Once an EIR is prepared, it is reviewed by the public and other agencies, and a decision is then made by the agency issuing the permit for the project as to whether or not to proceed with the project.

Laws and regulations regarding pesticide use are outlined in detail in Section C2.16 of this chapter.

**C2.02 Public Agencies Involved With Cooperative Enforcement of Vegetation Control Practices**

The following public agencies enforce regulations that affect vegetation control:

(A) California Department of Health Services (DHS)

DHS develops regulations for worker safety and hazardous material disposal. They cooperate in pesticide illness investigations and monitor domestic water supplies.

(B) Environmental Protection Agency (EPA)

This is the federal agency responsible for pesticide control. The EPA reviews State and county pest control programs for compliance with federal requirements. California EPA, and agencies under their direction, may provide additional requirements or regulations not required by the Federal EPA. The Department of Pesticide Regulation (DPR) is the regulatory arm of California EPA. DPR oversees pesticide regulations in California.

(C) State Water Resources Control Board and Regional Water Quality Control Board.

The regional boards (RWQCB) regulate pesticide container disposal sites and water quality standards.

(D) Air Resources Control Board and Regional Air Pollution Control Districts

The board and regional districts regulate dust control and burning.

(E) Division of Occupational Safety and Health

This division, known as Cal/OSHA, is charged with worker safety and protection when mixing, loading, and applying pesticides.

(F) California Department of Fish and Game

California Department of Fish and Game (DFG) cooperates in fish and wildlife loss investigations that may have been caused by pesticides.

(G) University of California

The University of California (UC) system is charged with pest control research and providing education to growers and licensees.

(H) U.S. Fish and Wildlife Service

This is the federal agency that enforces and protects rare and endangered plant and animal species.

Further information regarding pesticide regulation are outlined in detail in Section C2.16 of this chapter.

### **C2.03 Development of the Caltrans Vegetation Control Policy**

“Vegetation control” refers to the Integrated Vegetation Management (IVM) treatment of all plants growing within highway right of way, whether native, naturalized or in landscaped areas. Caltrans controls vegetation on State highway roadsides to maintain visibility of traffic control devices, to reduce the risk of fires starting along the roadside, to protect pavement surfaces, to control noxious weeds, to prevent erosion, to limit stormwater pollution, to protect sensitive species, and to improve aesthetics.

The IVM methods include chemical, thermal, biological, cultural, mechanical, structural and manual control.

Caltrans vegetation control policy was developed by a statewide committee in 1987. This policy called for a narrow clear strip (4 to 8 feet) next to pavement edges to control risk of fire, to provide for visibility, to provide space for emergency use, and to preserve the pavement. The policy strongly emphasized use of pre-emergent chemicals to suppress weed growth in the cleared strips.

The 1987 policy was the subject of a 1992 Environmental Impact Report (EIR). (Refer to Section C2.01 [E].) The Caltrans policy had been founded on using chemicals to develop fire control bare strips adjacent to shoulder edges. The EIR concluded that integrated vegetation management (IVM) principles should be incorporated in the Caltrans Vegetation Management Program. The EIR study gave new direction to Caltrans vegetation control philosophy. New policies were implemented as a result of the EIR.

Although the EIR established that chemicals could be used for vegetation control without compromising public, employee, and environmental safety, some public opinion expressed the desirability of reducing or eliminating the need to do vegetation control on highway roadsides.

This lower level of vegetation control would reduce herbicides in roadside environments. The Department set goals for reducing herbicide use 50 percent by the year 2000, and to achieve an 80 percent reduction by the year 2012.

The 50 percent goal was met July of 2000. Design changes will be required to meet the 80% goal by 2012.

Designs, strategies, and policies are being developed which will reduce the need for vegetation control. Research on alternative plant species for establishment along road edges is being conducted. Meanwhile, the guidelines for controlling vegetation contained in the “Caltrans Vegetation Control Policies” (green pamphlet) summarize the vegetation control policy of 1987. These policies are subject to district modification where an IVM strategy achieves control objectives.

The treatment widths recommended in the general policy section below are guides only and are to be adjusted to reflect fire risk and other conditions existing in each segment. Control decisions are to be documented by the Landscape Specialist in the Caltrans Vegetation Control Plan.

#### **C2.04 Caltrans Vegetation Control Considerations**

Caltrans Vegetation Control policy encourages the growth of native vegetation along highway roadsides. Safety, aesthetics, environmental laws, and compatibility with adjacent land use are the prime considerations in the proper maintenance of vegetation.

It is desirable to retain native vegetation and trees on roadsides compatible with the surrounding environment, safe highway use, aesthetics, erosion, and dust control. Vegetation helps to reduce driver fatigue, improves storm water quality, helps control erosion, maintains slope stability, and enhances aesthetics.

Vegetation should be controlled where necessary for fire prevention, safety, and reduction of noxious/invasive weeds. Removal of vegetation is generally restricted to a narrow band adjacent to shoulder edges, which is necessary to provide sight distance and protection of highway appurtenances such as guardrails and signs. Integrated Vegetation Management control alternatives should be considered on a site-specific basis.

Refer to District VegCon Plan in IMMS.

Districts are restricted in the use of herbicides as per the Caltrans Approved Herbicide List (refer to Appendix C2-A). Districts are also restricted to the use of adjuvants, as per the Caltrans Approved Adjuvant List (refer to Appendix C2-B). Contact your local District Landscape Specialist to obtain the most current approved lists.

The use of herbicides on Forest Service land is currently restricted. Future use of chemicals on Forest Service land is uncertain, but negotiations are in progress to clarify the environmental issues applicable to forest easements. Vegetation control work in National Forests should be coordinated with the local Forest Supervisor.

Roadsides should be managed on a site-specific basis using IVM methods. This provides the flexibility to adequately adjust treatments to the wide variety of roadside conditions.

### **C2.05 Statewide and District Vegetation Management Teams**

The Roadside Vegetation Management Committee (RVMC) was established to research and recommend design changes that reduce vegetation control needs. It also seeks to identify species of vegetation that can be established on highway roadsides to reduce vegetation control needs. The RVMC is assisted by a Public Advisory Liaison (PALs) committee, with membership from a cross section of vegetation control interests.

The RVMC has been assigned the following tasks:

- (A) Explore design changes that can be established in new and retrofit projects that will eliminate or reduce the use of pesticides.
- (B) Make recommendations for vegetation that will be low, slow growing, require less maintenance, and once established, reduce the need for pesticides.
- (C) Develop a database of sensitive resources along highway roadsides that must be considered in management strategies.
- (D) Recommend short-term strategies while new design standards are being developed.

The RVMC established the “Segment Specific” concept for planning vegetation control and recommended roadside management teams be established in each district to implement this concept. District Vegetation Management Teams (DVMT) meet to review new designs and recommend changes to achieve minimum vegetation control, consider life cycle maintenance commitments, and other consequences of planned vegetation regimes.

The district team also meets to consider the annual vegetation control plan (VegCon) proposed by the Deputy District Director, Maintenance.

District DVMT reviews both the annual plan and the mitigation checklist required by the EIR. The checklist implements the EIR’s programmatic feature and identifies further environmental studies which may be necessary. Should further statewide environmental studies be identified by District DVMT’s, the RVMC should take appropriate action.

The EIR is kept current by annual consideration of program components by the DVMT, using the mitigation checklist.

## **C2.06 Annual Plans**

Each district prepares an annual plan for vegetation control (VegCon Plan). The VegCon Plan is part of the Integrated Maintenance Management System (IMMS). This plan shall be derived from segment specific decisions which should consider fire risk management, safety, aesthetics, stormwater runoff, environmental laws, and community concerns. The plan is prepared each spring, and is the reference document for planning and scheduling Maintenance operations and for budget planning.

During the development of the annual VegCon Plan, districts shall consider vegetation control strategies that have been determined appropriate for the terrain and neighboring land uses. Strategies should provide minimum vegetation control necessary to maintain roadside visibility, drainage and drainage structures, sight distance for traffic visibility, and fuel load reductions appropriate for site conditions. Strategies should not compromise safety or the integrity of the highway surfaces.

In developing annual VegCon plans, districts shall take all applicable factors into consideration, including the following:

- Safety
- Sight distance
- Fire Risk
- Erosion
- Integrity of highway surfaces.
- Presence of environmentally sensitive resources:
  - Endangered Species
  - Sensitive plants
  - Archaeological Sites
  - Native American gathering sites
  - Mitigation sites
- School and Public stops
- Opportunities for design improvements to reduce the need for vegetation control.
- Aesthetic appeal

C2.06.1      Minimum Vegetation Control: Reduction of Chemical Use

Management decisions should identify the minimum vegetation control necessary to ensure adequate safety and system preservation. Decisions should take future needs and resources into consideration, as well as addressing short-term needs.

Long-term conditions most likely will require physical changes such as hardscaping or structural control methods to the pavement edge. These changes should be anticipated, documented and discussed with your District Landscape Specialist and Landscape Architect to ensure they are considered when the highway is reconstructed or rehabilitated. Refer to this manual, section E.12.7 for more information on structural weed control.

Short-term decisions should ensure that vegetation control is planned with chemical reduction goals in mind. The level of vegetation control should reflect an appropriate management decision that minimizes risks to safety requirements, visibility, fire risk, or the integrity of structural surfaces. When considering fire reduction strategies, the key is to assess the risk of fire starts in the right of way and the consequences of that fire escaping to surrounding terrain. Proper fire risk management cannot guarantee elimination of all fires. However, it should recognize the likelihood that a fire may start; the risk to people, property and the environment; and the difficulty of controlling fires.

C2.06.2      Fire Risk

A site specific fire risk plan is prepared by the District Landscape Specialist for the Deputy District Director, Maintenance. This plan establishes specific fire control measures for road edges, while considering the likelihood of a fire occurring and the consequences of a fire to the roadside and to adjacent properties.

Fire potential varies with the type of roadside vegetation and the configuration of the pavement edge. For example, grasses on a cut slope with a dike at its base are less likely to be ignited by a cigarette or spark than grasses on a flat traversable roadside. Similarly, perennial or low growing annual grasses present fewer fire risks than tall annual grasses.

The chance and consequences of a fire escaping vary widely with conditions. The consequences of fire spreading to an adjacent forest may be more serious than fire spreading to desert, chaparral or grasslands. Likewise, the consequences of a roadside fire where there is a containment barrier such as a frontage road or sound wall are less than if the fire can spread unimpeded into adjacent terrain.

The VegCon Plan must consider fire risk in sufficient detail to reflect changing vegetation types along highway edges, differing adjacent land uses, highway configurations, and annual rainfall impacting expected vegetation growth which may increase/decrease fire risk, and urban interface. Refer to District VegCon Plan in IMMS.

#### **C2.06.3      Edge Treatment**

Vegetation management should begin at the planning or preliminary design stage of a new project. The design of the shoulder edge as it transitions to the roadside is the most important factor affecting the need for vegetation control. Details of this transition affect the need for vegetation control. Such details may include whether the edge is flat, fill or cut; slope steepness and vehicle traversability; paved and unpaved shoulder widths; and drainage requirements. Edge treatments are determined by the District Landscape Specialist, and is part of the Caltrans Vegetation Control Plan.

The design should carefully consider pavement edge transition details that will minimize the need for vegetation control and provide positive, long-term relief from this maintenance responsibility. The designer should take into consideration future maintenance strategies. For example, if mowing will be required, the roadside should be graded and kept obstacle free to protect equipment and people while also reducing fire starts. Roadsides to be landscaped should be designed to accommodate landscaping features and provide safe access for personnel and equipment. Careful attention to design should minimize vegetation maintenance expenditures over the life of the project, facilitate the appropriate vegetation concept, reduce the need for pesticides, and minimize public concern for vegetation control methods.

C2.06.4 Vegetation Control Plan (VegCon Plan)

The VegCon Plans should be completed in IMMS by April 1 of each year. It shall contain details for vegetation control on roadsides (C Family), landscaped areas (E Family), vista points, Park and Ride lots, and Safety Roadside Rests Areas (G Family).

The VegCon Plan will consist of site-specific vegetation control methods as outlined below:

- (A) Chemical vegetation control noting planned usage with chemicals separated into “C”, “E”, and “G” Families, including pounds of active ingredient (A.I.).
- (B) Mowing Program separated into “C”, “E”, and “G” Families.
- (C) Other non-chemical IVM control (mulch, thermal, structural, etc.) separated into “C”, “E”, and “G” Families.
- (D) Listing of sensitive areas.
- (E) Pounds of A.I. needed for noxious weed control in the district.
- (F) Other chemical pest control (insects, snail, rodent, etc.) separated into “C”, “E”, and “G” Families.
- (G) Fertilizer needs separated into “C”, “E”, and “G” Families.

The VegCon Plan shall also contain planned control by permit.

## **SECTION 2: Control of Native Plants (Non -Landscaped Areas)**

### **C2.07 Non-Landscaped Vegetation Control**

General non-landscaped vegetation control refers to the Integrated Vegetation Management (IVM) treatment of all vegetation growing naturally within the highway rights of way. The control methods include chemical, biological, cultural, mechanical, thermal, structural, and manual.

### **C2.08 Disease and Insects**

Corrective actions should be taken where trees and shrubs growing naturally are affected by disease or insect infestations that are detrimental to the health of the trees or create a significant nuisance to the traveling public or adjacent landowner.

Prior to use of chemical means of control, districts should consider use of natural or biological controls as described in this section.

Some level of disease and insect infestation is natural, and does not impair the health of the plants. Control measures should be employed when the infestation threatens the viability of the plant, or when it threatens adjoining properties. No attempt should be made to keep all plants free of all insects by spraying.

If it is determined that it is necessary to use chemical means of control, refer to Section 3 of this chapter, "Use of Pesticides."

#### **C2.08.1 Biological Control**

Biological control will frequently keep a potential insect infestation under control with only a minimum loss of foliage.

Biological control of pests is accomplished by releasing predators and/or parasites. The predators consume unwanted pests, and the parasites use the pest insect body as an egg-depositing site. After the egg hatches, the larvae feed on the host insect. Weeds are controlled in the same manner, with the biological agent either eating the weed, or laying an egg and the larva eating the weed from the inside.

The biological agents are typically insects, fungi, or microbes. An advantage of this concept is that once the predatory agent becomes established, it continues to exist at a population level that is in balance with the availability of the host.

Biological control agents such as *Bacillus Thuringiensis* (BT) are being used successfully on California oak moth and Red Humped Caterpillars. B.T. is a bacteria that paralyzes the stomach of feeding larvae (or worm stage of development) of certain moths and butterflies. Successful control of puncture vine by weevil, pepper tree psyllids, by wasps, and eucalyptus tree long-horned beetle by wasps are other examples of natural control. Research for predators for other pests, for example Yellow Star Thistle and Russian Thistle, is ongoing.

It is possible to improve the level of natural control by improving the environment for the predators. Where natural methods are being employed for the control of a pest, chemical pesticides should only be used when an infestation becomes acute. Biological control of pests is often the most satisfactory method of eliminating or reducing pests because of the long lasting control which normally results in lessening the workload.

### **C2.09 Pruning of Vegetation**

Prune vegetation to preserve the health and structure of trees and native shrubs, to prevent damage to Caltrans and adjacent property, and to provide safety for vehicular and non-motorized travelers.

Use the following guidelines when developing a pruning program:

#### **(A) Required Clearance for Visibility**

Trees and shrubs should be trimmed to maintain visibility of highway signs and safety devices, and to provide 17 feet of clearance over the traveled way and shoulder.

Trees may be trimmed by encroachment permit for purposes of providing visibility to outdoor advertising signs or business property frontage. Refer to the guidelines for evaluating visibility improvement requests from the Office of Landscape Architecture or the District Encroachment Permit Office.

Visibility improvement guidelines require median planting (oleanders) to be pruned not lower than five (5) feet.

#### **(B) Vegetation Control to Prevent Accumulation of Snow and Ice**

Whenever feasible, prune or remove trees and shrubs where snow and ice creates slippery conditions. Pruning or removal in such cases reduces ice by permitting exposure of the pavement to wind and sun.

(C) Removal of Plants or Trees

Follow your district's policy on proper approvals. Signatures or approvals from the Landscape Specialist and above may be required prior to the removal of live trees.

Dead plants or trees within the right of way should be promptly removed when required for safety or protection of adjacent property.

(D) Pruning

Pruning shall be conducted in conformance with ANSI Standard A300-1995. Refer to Chapter "E" of this manual.

(1) Directional Pruning

Most utility companies encourage directional pruning of trees adjacent to utility lines. Trees pruned in this manner are generally healthier and have stronger limbs.

Trees subjected to severe canopy reduction associated with conventional pruning methods are often weakened. However, directional pruning may result in a less pleasing appearance. Overall maintenance costs are lower with directional pruning. Trees with high appearance value should not be directionally pruned.

## **C2.10 Tree Inspection**

Conduct, to the extent reasonable, a visual surveillance to detect trees and limbs that may be hazardous to traffic, including motor vehicles and non-motorized travelers, highway appurtenances, or adjacent property.

It is often difficult to detect conditions such as loss of root support, interior rotting and split limbs. Trees disturbed in construction areas or with obvious structural deficiencies may require a thorough inspection to determine appropriate actions. Consult your Tree Maintenance Supervisor or District Landscape Specialist when the need arises.

### **C2.11 Vegetation Control of Specific Areas**

Vegetation control considerations should include:

**(A) Traversable Slopes (4:1 and flatter)**

- (1) A control strip up to 8 feet wide for maintenance along the paved shoulder edge of both two lane and multi-lane roadways should be considered. Wider strips may be dictated by extreme fire control needs.
- (2) Medians wider than 36 feet should maintain a control strip up to eight (8) feet wide from the pavement edge of both sides of the median. The presence of glare screen plantings or median barriers may warrant the total control of median vegetation from pavement edge to plantings/barrier for safety, appearance, or fire control.
- (3) Medians less than 36 feet in width may be considered for vegetation control of the entire width for appearance or fire control.

**(B) Slopes (Steeper than 4:1)**

From the paved shoulder edge, a control strip up to four (4) feet wide along fill or cut slopes should be considered.

**(C) Miscellaneous Areas**

- (1) Control vegetation within two (2) feet of guardrails, delineator posts and other safety hardware where they are not included in shoulder treatment.
- (2) Control vegetation in dirt ditches and culvert inlets and outlets to facilitate drainage. Minimize and control runoff into drainage pathways and waterways. Please refer to the Maintenance Staff Guide, Appendix C.23.1 – Vegetated Treatment Systems (Biofiltration Swales and Strips).
- (3) Mowing entire interchange areas may be desirable for aesthetics or fire control in urban or developed areas.
- (4) Mow, as needed, for visibility and sight distance on horizontal curves, ground mounted signs and intersections.
- (5) Clearing of vegetation around buildings may be necessary for fire prevention.

- (6) Vegetation control within city limits should be agreed upon by Caltrans and the city, and should be consistent with the control methods of the community.
- (7) Do not mow vegetation to a height of less than six (6) inches. Mowing at a lower height risks scalping the ground which may encourage unwanted weeds, increase the chance of throwing rocks, cause fire starts, and could damage mowers. A taller cut may be recommended by the District Landscape Architect or Landscape Specialist for specific areas.

The timing of mowing is critical to minimize or reduce the spread and proliferation of noxious weeds such as Yellow Star Thistle or Russian Tumbleweed. It is important to understand the growth habits of the native vegetation and invasive weeds to minimize the spread of noxious weeds. It is best to work with a local subject matter expert and a biologist that understands the particular issue with the roadside environment in order to develop a mowing strategy that will optimize the growth of native self-sustaining vegetation.

- (8) Except as provided above, avoid mowing beyond control strips in rural areas. Such mowing increases the incidence of fires due to hot mufflers igniting stubble. Mowing also encourages broad-leafed weed growth by diminishing competition from the grasses.
- (9) Treat noxious/invasive weeds where requested by the County Agricultural Commissioner and weed management areas. Caltrans will cooperate in an area wide control of noxious/invasive weeds if established by local agencies. The desire by adjacent farmers to control weedy pests doesn't meet the requirements of above. Farmers/landowners who request weed control on State right of way that is not identified in the VegCon plan should be encouraged to submit a permit request application for weed control, identifying weeds and control method desired.

Refer to Section 3: Use of Pesticides.

**(D) Brush And Tree Control**

Native brush and seedling trees naturally occur on roadsides, encroaching into the roadway, and obstructing safety hardware and drainage. Control brush and seedling trees as necessary to provide sight distance on curves and clear unpaved shoulder areas, safety hardware, and drainage. All brush and seedling trees should be controlled nine (9) feet from the pavement edge.

In heavy brush areas, trim and remove brush selectively to avoid a straight or carved edge, and to encourage a more natural meandering appearance. Seedling trees should not be allowed to become established in a clear recovery area.

Brush and seedling trees may be removed with a brush mower or by hand work. When necessary, treat stumps to prevent growth resurgence. Do not allow seedling trees to grow in locations where they can grow to become a hazard.

Heavy-duty mechanical brush cutters are effective for brush control, and when used, cutting should be close to the ground. Limbs on the underside of trees should not be cut with a brush mower. The quality of work should be professional and equal to that required by encroachment or utility permit specifications. Follow arboricultural standards and procedures.

Brush trimmings may be chipped or hauled away. Chips may be spread over the ground in forest areas and other locations. Pay particular attention to the possibility of the chips floating into gutters and clogging drains, or becoming a fire hazard when dry. There are locations where chips should be hauled away for these reasons. In some locations, excess chips can be taken to cogeneration plants. Wood chips can be used as an effective mulch in landscaped plantings. Avoid chipping poison oak. Take special care not to spread poison oak chips in landscaped areas. It is also important not to spread pests with chipped material. For example, pine pitch canker and Sudden Oak Death syndrome can be spread with chipped material.

Mechanical brush removal operations have potential to start fires in dry conditions. Keep a source of water and fire suppression tools nearby. Consider suspending work when extremely high fire risk conditions exist.

Refer to Section C2.26.6: Brush Spraying.

#### (E) Burning of Roadside Vegetation

Burning of roadside vegetation is a valid IVM method of vegetation control to renew soils, remove unwanted species, and encourage the growth of native species which depend on fire for seed germination. Planned burns shall be included in the VegCon Plan.

Any burning of roadside vegetation and slash shall be done in conformance with local burning and air quality regulations. Fire officials shall be notified in advance of planned burns. Burning shall be conducted only when weather conditions are favorable for good smoke dispersion.

See Chapter 1, Section 1.23.5 of this manual: Air Quality.

### **C2.12 Vegetation Control By Others**

Caltrans may issue permits to individuals or organizations for control or harvesting of vegetation, in addition to Adopt-A-Highway vegetation control permits. The permittee must comply with all applicable laws and Caltrans policies.

### **C2.13 Shoulder Grading and Disking**

Shoulder grading is not an acceptable method of vegetation control. Grading shall be performed for the purpose of restoring lateral support to the pavement edge, and should be limited to the actual area necessary to correct the lateral support problem. It may be necessary to provide a higher quality material to retain lateral support if repetitive grading is necessary.

Disking is not an acceptable method of vegetation control. Disking could be considered adverse to the Department's storm water permit. However, disking to prepare for a seed bed followed by seeding and recompact the soil could provide long-term benefits, such as erosion control and improved establishment of desired vegetation.

### **C2.14 Variances**

California has many variations of climate, terrain and native species of vegetation. No single policy can be applicable for all prevailing conditions. Consequently, deviations from stated policies may be appropriate. Exceptions shall be justified in the District VegCon Plan.

### **C2.15 Highway Tree Maintenance**

Highway trees are to be maintained in a safe and aesthetic manner at all times. Districts shall employ the best standards of arboriculture, consistent with the practices outlined in publication: American National Standard (ANSI) A300-1995, and the ISA tree pruning guidelines.

Keep trees free of weak or dead limbs. When there is time and available resources, thin and shape trees as needed to provide for safety, health, and beauty of the tree.

There is a distinction between shrubs, seedlings and trees. A "tree" is a woody perennial plant with a diameter of four (4) inches or greater (when measured 4 feet from the ground), and has a total height greater than 20 feet.

Only qualified personnel are authorized to fell trees. Maintenance personnel who are not in a current Caltrans Tree Maintenance classification must be qualified by a Caltrans Tree Maintenance Supervisor before they may fell trees.

Maintenance employees who have non-Caltrans training and experience in felling trees may become qualified through the Tree Feller Qualification Program. Contact Headquarters Maintenance Division, Office of Roadside, for assistance if your district does not have a Caltrans Tree Maintenance Supervisor.

#### **C2.15.1 Working in Trees**

##### **(A) Laws, Regulations and Policy Pertaining to Tree Work**

The California Code of Regulation, Title 8, Article 12, regulates worker safety in tree trimming operations. The American National Standard, (ANSI) Z133.1-1994, provides standard practice for work in trees. In the event of any conflicts between ANSI guidelines and Cal/OSHA regulations, the Cal/OSHA regulations shall take precedence.

See Chapter 8 of this manual: Protection of Workers. Also refer to the Code of Safe Practices (COSP) for work in trees, and the COSPs for the specific equipment employed in the work.

There are different requirements for working around and maintaining clearances to high voltage lines (600 volts and greater) and low voltage wires. Check the above policies and regulations for further information.

It is Caltrans policy that all overhead conductors including guy wires, phone wires, cable TV and other lines (whether energized or not) shall be considered live. Such lines shall not be touched by personnel directly or with equipment. Trimmings shall not be allowed to come in contact with wires. Caltrans crews shall not engage in line clearance operations.

##### **(B) Qualifications for Working in Trees**

Only qualified tree trimmers or trainees are to perform work in trees. The safety of tree workers depends upon adherence to the following established regulations, guidelines, safety orders and policies.

While tree trimming operations involving climbing are in progress, there shall be a qualified climber on the ground to direct the operations and to assist in rescue operations if necessary.

**(C) Clothing**

Clothing must be appropriate for the work. Clothing should be close fitting and untorn to prevent the possibility of it being drawn into power or hand tools. Boots or high shoes with full composition soles and heels should be worn. Oxfords and light sports shoes, such as running shoes or cross-training shoes, shall never be worn by climbers in trees.

**(D) Climbing Gear**

Climbing ropes shall be a minimum of ½ inch first grade, synthetic tree surgeon's rope. The rope shall be approved by the Tree Maintenance Supervisor. It shall be checked frequently by the Tree Maintenance Worker and his or her supervisor for cuts or weakened areas. Ropes shall be kept in separate boxes on the truck where they are dry and not mingled with tools or exposed to fuel. Limbs shall not be lowered with the climbing rope. Separate ropes shall be available for other purposes than climbing.

A tag line must be attached to the safety saddle. The tag line shall be used by the tree climber at all times when the climber rope is not secured to the tree and saddle.

Safety saddles must be ANSI approved. Saddles shall be checked frequently for weakened parts, and repaired or discarded when not safe to use.

Climbing spurs shall not be used in highway trees either by State forces or others who are working under permit, except in the removal of dead or dying trees, or in the tops of extremely high eucalyptus, palms or some coniferous trees. Spurs will conform to ANSI standard 2133 or A-300.

**(E) Use of Brush Chippers**

Brush chippers are important tools for tree workers. It is important that they be used properly and safely in accordance with applicable safety instructions. Only employees that are qualified are to operate brush chippers. See section for brush removal above regarding proper disposal of chips.

Prior to use of brush chippers, review the operating instructions, the COSP, and Best Maintenance Practices (BMPs).

(F) Chain Saws

Chain saws are frequently used by tree workers. They may be very hazardous if used improperly. Only operators formally qualified by Caltrans training are allowed to use chain saws. Operators must adhere to appropriate safety instructions outlined in the COSP and the operator's manual.

Prior to use, chain saws must be inspected to ensure a sharp and balanced chain, proper chain adjustment, proper lubrication, overall tightness of bolts and parts, and cleanliness.

Only qualified tree workers and approved trainees shall use chain saws in trees. Two (2) workers are necessary for operations with chain saws in trees. One (1) worker must be on the ground. The worker on the ground shall be qualified in aerial rescue, and must stay in the immediate vicinity to assist the worker in the tree in case of accident.

Pole mounted, hydraulic chain saws should only be used by formally qualified workers. Such qualification is given in addition to the Caltrans chain saw qualification course.

Apply the following when using chain saws:

- (1) Operators shall not use chain saws until they have received instructions on use and care of the saw, and training regarding safety rules.
- (2) The chain saw operator should not walk with chain moving.
- (3) Saws shall not be operated while alone. Someone must be close by.
- (4) The chain must be kept sharp.
- (5) The saw should never be forced. The chain should be allowed to do the cutting.
- (6) The saw must be kept in adjustment so it will idle without chain moving.
- (7) Operators must have a good footing and a firm hold when starting the saw.
- (8) Hard hats and eye protection shall be worn at all times when operating a saw.
- (9) Ear plugs or muffs, or both, shall be worn when operating a saw.
- (10) The chain saw operator or another responsible person must warn others when felling limbs or trees.

- (11) The chain saw should be hoisted to the tree worker on a separate line once the tree worker is in the tree and the climbing line is attached to the safety belt.
- (12) Chain saws weighing more than 20 pounds (service weight) that are used in trees should be supported by a separate line, except when working from an aerial lift device, or during topping or removal operations.
- (13) Chain saws weighing less than 20 pounds (service weight) may be carried on the tree worker's belt after being hoisted into the tree. This can be accomplished by attaching a short safety line to the chain saw handle and the tree worker's belt. The safety line should be of sufficient size and length to allow the saw to drop below the worker's body in case of an accident.
- (14) Chain saws in use in trees should be shut off when changing working positions.
- (15) Only safety type chains (anti-kickback) should be used on chain saws. These have fewer tendencies for kickback than do cross cut chains.
- (16) Workers using chain saws on the ground are required to use industry approved leg protection (chaps). Such protection is optional for workers in the trees.

**(G) Personnel Hoists and Hydraulic Tools**

Operators of personnel hoists must be qualified by the Maintenance Division and must follow safety procedures in the COSP.

ANSI Z-133.1-1994 provides guidelines for clearances that should be maintained from electrical wires. Cal/OSHA requires line clearances for wires containing 600 volts or greater.

Caltrans workers shall avoid contact with all electrical lines carrying over 600 volts. Even when a line carries less than 600 volts, workers shall work no closer than within three (3) feet of the wire.

**C2.15.2      Topping (Heading) Highway Trees**

Highway trees shall be topped only if extreme height has made them a hazard to traffic or property. Consideration should be given to removal of the tree before topping or thinning. Live tree removal must be approved by the District Director. Tree topping may be an alternative option to removal in some cases.

Topping of trees shall be done by drop-crotching to healthy, strong lower crotches and laterals in accordance with ANSI A-300 standards. Cut to laterals no less than one-third (1/3) of the diameter of the original limb, and remove no more than one-quarter (1/4) of the total leaf surface. A topping job shall result in a well-balanced and proportioned tree of natural shape for the species. The sides must be reduced in spread in proportion to the amount of top cut off. Directional pruning is an exception to this policy and shall be approved by the District Landscape Specialist.

No stub or ledge cuts shall be left after the removal of limbs. Undercut all limbs before removal to prevent breaks or tearing of the bark (refer to Illustrations in Appendix C2-D). Final cuts shall be made nearly flush with the parent branch or trunk, leaving a callus ring but not a stub.

See Appendix C2-D: Illustrations in Pruning Methods

#### C2.15.3 Tree Removal

When removing a tree that is outside the limits of blading or mowing operations, cut the trunk level with the surrounding ground. Either remove the stump or cut it off eight (8) inches below the surface when it is within the limits of blading or mowing operations. The recommended method of stump removal is grinding.

Stumps of species of trees which continue to sucker after tree removal shall be treated chemically or the stump should be removed by grinding. Glyphosate and triclopyr are suitable chemicals for treating cut stumps. The District Landscape Specialist must provide a chemical use Recommendation prior to use of stump treatment.

#### C2.15.4 Arboricultural Practices

Tree surgery procedures are rarely performed on trees in highway right of way. If it is required, it should be performed in accordance with appropriate ANSI standards.

#### C2.15.5 Tree Removal in National Forests

The State may remove trees within the easement boundary that are deemed hazardous by the State. In addition, the State may remove small trees that encroach on lines of sight or for safety purposes as specified in the approved plan. Removal and disposal of these trees will be coordinated between the District Ranger and the Maintenance Manager.

## **SECTION 3: Use of Pesticides**

### **C2.16 Laws and Regulations Regarding Use of Pesticides**

The terms used in the laws and regulations sometimes have a different meaning than words in common usage.

The words “shall” and “may” are used extensively in laws and regulations. Their meanings are quite different. “Shall” is mandatory; “may” is permissive.

The term “pesticide” means any material used to control pests. Some examples are insecticides (control insects), herbicides (control vegetation), rodenticides (control rodents), and avicides (control birds).

The terms “pesticides” and “economic poison” have the same meaning in the law.

#### **(A) Food and Agriculture Code**

This code defines the roles and responsibilities of county agricultural commissioners and the Department of Pesticide Regulation (DPR) in relation to the use of herbicides. Section 11501.1 relates to the field of pesticide regulation. The control of economic poisons rests with Cal/EPA and not local agencies. This law does not change in any way the present relationship between the County Agricultural Commissioner and Caltrans for pesticide purchases and application within each county. This division is not a limitation on the authority of any State agency or department to enforce or administer any law or regulation when they are given that authority.

Sections 5501-5509 (AB 1245) provides for the control of roadside vegetation by adjoining landowners under permit.

#### **(B) Penal Code**

This code lists penalties for not complying with State pesticide regulations and laws. Caltrans may be held liable for the actions of its employees. Employees who negligently or intentionally misuse pesticides may be held criminally liable for their actions. An employee is “negligent” if he or she does not use reasonable care. An employee “intentionally” misuses pesticides when he knows that he is breaking the law, but acts in an illegal manner.

(C) Streets and Highways Code

Section 862 describes the liability of public entities for injuries caused by the use of pesticides.

Where there is an intentional violation of the law which creates, or could have reasonably created, a hazard to human health or the environment, the convicted person shall be punished by imprisonment not to exceed one (1) year or by a fine of not less than \$5,000 nor more than \$50,000, or by both.

(D) General Industry Safety Orders (GISO)

GISO Section 3204 (known as “Employee Right to Know”) provides employees the right of access to relevant exposure or medical records. Each employee has the right and opportunity to examine and copy any data in the employee’s medical and exposure records. An employee may also give written authorization to a designated representative for access to the information.

## **C2.17 Certification for Applicators of Restricted Materials**

The amended Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) has two key provisions:

- The U.S. Environmental Protection Agency (EPA) is required to classify all pesticide products for “general” or “restricted” use.
- Restricted use pesticides may be used only by, or under the direct supervision of Certified Applicators.

California Department of Pesticide Regulation maintains a list of restricted materials that includes pesticides and any material that USEPA or CAL EPA has designated as restricted.

(A) General Use Pesticides

“General Use Pesticides” are those that will not ordinarily cause unreasonable adverse effects to the user or the environment when used in accordance with their registered labeling instructions. Such products are available to the public without further restrictions other than those specified in the labeling.

(B) Restricted Use Pesticides

“Restricted use pesticides” are those which may cause adverse effects to the environment or the applicator unless applied by competent individuals who have demonstrated their ability to use these products safely and effectively.

(C) Pesticide Applicator Certification

Federal law states that no person shall apply restricted use pesticides unless that person is certified or is supervised by a certified or licensed applicator.

The law recognizes two types of pesticide applicators:

(1) Private Applicators

Private applicators include farmers, ranchers, orchardists, or other applicators who use or supervise the use of restricted materials to produce an agricultural commodity on property they own or rent.

(2) Commercial Applicators

Commercial Applicators are those who apply or supervise the use of restricted materials on any property other than as provided by the definition of “private applicators.”

Caltrans personnel who apply restricted use pesticides are considered “Commercial Applicators” and shall either be certified through an applicator certification program, or supervised by a Certified Applicator.

(D) Requirements for Qualified Applicators Certification (QAC)

Commercial Applicators will be certified by the California Department of Pesticide Regulation after passing examinations designed to meet EPA competency standards.

The following are the categories of pest control established by the California Department of Pesticide Regulation for applicator certificates:

<b><u>CATEGORY</u></b>	<b><u>CERTIFICATION</u></b>
A	Residential, industrial and institutional
B	Landscape Maintenance
C	Right of way
D	Agricultural
E	Forest
F	Aquatic
G	Regulatory
H	Seed treatment
I	Animal Agriculture
J	Demonstration and Research
K	Health Related
L	Wood Preservation
M	Antifouling – Tributyltin
N	Sewer Line Root Control
Q	Maintenance Gardner

Categories B and C are applicable for Caltrans roadsides.

### **C2.18 Recordkeeping**

Pesticide applicators are required to keep adequate records. These records shall be kept by the supervisor in charge of the operation.

State law requires that the information on this report be kept for 30 years. Pesticide use is presently reported to HQ on a daily basis via electronic time sheets approved by supervisors. At the end of the month, this pesticide use summary is electronically sent to DPR.

The following information shall be included:

- (A) Location of application (include county, route, post mile limits nearest 1/100th mile, width of application, and description of location relative to roadway, e.g., right shoulder or median).
- (B) Name of chemical(s) used. (Include percent of active ingredient, and if stated on label, the formulation, e.g., "DF" for dry-flowable or "W" for wettable powder.
- (C) Rate of chemical(s) applications per acre.
- (D) Purpose of treatment.
- (E) Total acres treated.
- (F) Total gallons sprayed.
- (G) Actual time of spraying.
- (H) Approximate wind speed and direction.
- (I) Personnel, safety gear, and equipment involved. Respirator use is recorded separately.
- (J) Remarks that clarify any unusual circumstance or happening relating to the use of the chemical.

### **C2.19 Pesticide Use Recommendations**

Herbicides can only be used when authorized by a Pesticide Use Recommendation prepared by a licensed Pesticide Control Advisor (PCA). Field work should be supervised by person who has a valid Qualified Applicator's Certificate (QAC). When using restricted pesticide materials, a QAC is required. These requirements are for work performed on all Caltrans right of ways.

## **C2.20 Requirements for Safe Handling and Storage of Pesticides**

The following are legal requirements for pesticide handling and storage.

### **C2.20.1 Medical Care**

For all activities involving the use of pesticides, the employer (supervisor) shall make prior arrangements for emergency medical care.

The name, address, and telephone number of the physician, clinic or hospital emergency room providing care shall be posted in a prominent place at the work site, or in the application vehicle if there is no designated work site.

When the employer (supervisor) has reasonable grounds to suspect that an employee has a pesticide illness, or when an exposure to a pesticide has occurred that might reasonably be expected to lead to an employee's illness, the employer shall take the employee to a physician immediately, along with an uncontaminated pesticide label and MSDS (if possible).

### **C2.20.2 Personal Washing Facilities**

Regulations require that clean water, soap, and single-use towels be available at the work site for washing of hands and face, and for emergency washing of the entire body a minimum of 10 gallons of water for one employee, and a minimum of 20 gallons for two or more employees. Regulations also require that a clean change of clothes be available at the work site in case work clothing or protective clothing becomes contaminated. An extra pair or two of disposable coveralls shall be carried with spray crews. Extra coveralls should be large enough to fit the largest person on the crew.

### **C2.20.3 Storage of Chemicals**

The California Health and Safety Code requires each facility that stores hazardous materials to develop a "Business Plan." This Business Plan lists the types of chemicals, including pesticides, that are on the premises, the amounts, and storage locations.

Hazardous materials storage areas must be placarded. Post the proper signs on pesticide storage buildings and in outside storage areas. These signs are required by law, and must be placed so they will be readily visible to firefighters or emergency response personnel entering each area.

Chemical pesticides must be stored in well-ventilated rooms. Fertilizers must not be stored in the same room with pesticides. Storage areas must be kept locked when not in use. Pesticide storage warning signs, written both in English and Spanish, must be posted on all sides of approach where pesticides are stored.

Chapter “F” of this manual provides additional guidelines for storage of pesticides and other hazardous materials.

#### **C2.20.4        Disposal of Empty Chemical Containers**

Pesticide regulations require special attention be given to the disposal of empty pesticide containers.

Pesticide containers that hold less than 28 gallons of a liquid pesticide must be rinsed and drained (when empty) by the user at the time of use. The containers shall be triple rinsed, with the rinse solution from the container drained into the spray tank.

Pesticide containers shall be allowed to drain 30 seconds into the spray tank after each rinsing.

The rinse solution shall be placed into the mix tank and then applied onto the roadside, in the “target area.”

Empty, rinsed pesticide containers shall be perforated, crushed, or broken to eliminate the possibility of their reuse for any purpose. Plastic containers may be recycled by the County Agricultural Commissioner.

Contact the County Agricultural Commissioner for information on proper disposal areas.

Properly rinsed empty containers shall be taken to these sites.

#### **C2.20.5        Labeling of Spray Rigs and Tanks**

A warning decal, “Warning, Not Drinking Water”, shall be placed on the rear and both sides of the tanks of all spray units.

A “Do Not Drink” decal shall be placed near each of the fresh water tank valve outlets so that it can be easily seen.

Two placard holders shall be mounted, side by side, near the main outlet of the tank so that it is easily visible from the rear of the unit. Placards with the name of the chemical being used and containing appropriate warnings will be in place during spray operations. Placards may be obtained from Material Operations.

### **C2.21 Environmental Concerns**

When preparing the district VegCon Plan, special consideration shall be given to the possible chemical contamination of surface and ground water. Maintenance operations shall be conducted with full consideration for potential effects on water quality, air quality, sensitive species and other environmental resources.

Refer to Chapter “F” of this manual for further information for water quality issues.

Refer to Chapter “D5” for procedures to be followed in the event of spills of hazardous materials on highways.

### **C2.22 Toxicity of Chemicals**

Toxicity is the capacity of a material to cause injury or death. Toxicity ratings are expressed for each chemical used in pesticide work. These toxicity ratings are expressed as Oral or Dermal LD 50. LD 50 is the lethal dose that will kill 50 percent of a group of laboratory animals. It is expressed in terms of milligrams of material for each kilogram of body weight. The lower the number on this scale, the more hazardous the material to human health.

In general, pre-emergent herbicides pose a greater hazard to aquatic life than post-emergent herbicides, and some adjuvants have been shown to be toxic to aquatic organisms. It is therefore important to minimize the potential for vegetation control products to enter watercourses and thus prevent harm to aquatic wildlife and prevent degradation of water quality. Buffer zones of up to 20 feet or greater should be maintained from surface water (oceans, bays, lakes, rivers, streams, creeks and canals) or drainage ditches (when water is flowing) when applying any pre-emergent herbicide. Buffers of five (5) feet or greater should be maintained from surface water when applying post-emergent herbicides. When it has been determined that the use of herbicides is the best IVM method in close proximity to surface waters, consider using material that the Department of Pesticide Regulation has approved for aquatic applications. Due to changing regulation with regard to threatened or endangered aquatic wildlife, greater buffers may be required when using specific herbicides.

Refer to the VegCon plan in IMMS with regard to sensitive resources. This portion of the plan provides site-specific information on school bus stops, certified organic farms, well locations, and biological resources.

Pesticides may enter the body by one or all four (4) of the following routes: skin absorption (dermal), ingestion (oral), respiratory (lungs), or ocular (eyes).

Maintenance personnel shall not use any material with an LD 50 lower than 100.

Use the pesticide with the lowest toxicity (the highest LD 50 number) adequate to do the job.

The following scale is provided for judging the toxicity of pesticides:

<b>COMMONLY USED TERM</b>	<b>LD 50</b>	<b>PROBABLE LETHAL DOSE FOR HUMANS</b>
Extremely Toxic	less than 1	A taste or grain
Highly Toxic	1 to 50	1 pinch to 1 teaspoon
Moderately Toxic	50 to 500	1 teaspoon to 2 tablespoons
Slightly Toxic	500 to 5,000	1 ounce to 1 pint
Practically Non-Toxic	5,000 to 15,000	1 pint to 1 quart
Relatively Harmless	15,000 or more	Greater than 1 quart

These toxicity values are expressed as LD 50 in terms of milligrams of the chemical per kilogram of body weight of the test animal milligrams/kilograms (mg/kg).

Although LD 50 ratings may not appear on pesticide labels, the following terms are set by law, and can be used to judge the acute hazard of the material:

<b>SIGNAL WORD</b>	<b>WHEN REQUIRED</b>
“DANGER - POISON” (If “Poison” then label contains skull and crossbones)	All highly toxic compounds with an LD 50 range of 0 to 50 mg/kg
“WARNING”	Moderately toxic compounds with an LD 50 range of 50 - 500 mg/kg
“CAUTION”	Slightly toxic compounds with an LD 50 range of 500 to 5,000 mg/kg

No special words are required for compounds with an LD 50 greater than 5,000 mg/kg. However, they must have the statement “Keep out of reach of children.”

There are four (4) general categories of pesticides based on these toxicities. Knowledge of the meaning of the signal words and symbols forewarns the pesticide user of potential hazards associated with the chemicals.

CATEGORY	SIGNAL WORDS and SYMBOL	NOTES
1	“DANGER - POISON” if “Poison” then label contains skull and crossbones symbol	Some pesticides carry only the signal word “Danger” without “Poison” or the skull and crossbones symbol. They are in Category 1 due to a specific hazard, such as potential for skin or eye injury, and are highly toxic.
2	“WARNING”	Moderately toxic compounds.
3& 4	“CAUTION”	Slightly toxic.

### **C2.23 Annual Pesticide Worker Safety Training**

State law requires annual Pesticide Worker Safety Training for all employees who work with pesticides or may be exposed to their residues. The training is designed to teach safe work practices for employees who mix, load, apply, store, or otherwise handle pesticides.

Chapter “C2”, Section 3, of this manual is the Department’s written pesticide safety program. As a minimum, the annual pesticide safety training shall include the following points:

#### **(A) Pesticide Labels**

The directions on pesticide labels are enforceable by law. It is a violation of the law to use a pesticide inconsistent with its label. Supervisors shall review specific pesticide labels and MSDS’s with their employees prior to them using the material, and annually thereafter.

Employees shall be taught how to read pesticide labels. They shall be able to recognize signal words, determine the hazards of the material, and select the types of required personal protective gear.

See Section C2.22: Toxicity of Chemicals.

(B) Storing, Transporting, and Disposal of Pesticides

New employees shall be instructed in the proper storage of pesticides, provided specific information on how to secure and transport pesticides, and how to properly dispose of empty pesticide containers. Review N-2 of the Pesticide Safety Information Series. See Section C2.20.3 – Storage of Chemicals and Section C2.20.4 – Disposal of Empty Chemical Containers.

(C) Closed Systems, Enclosed Cabs and Water Soluble Packaging

Although the Department does not use closed systems, the use of enclosed cabs and soluble packaging should be discussed with employees, and how these safety features reduce exposure. Review N-3 of the Pesticide Safety Information Series.

(D) Emergency Medical Care

Employees shall review the arrangements for emergency medical care for workers involved in activities with pesticides. Medical facility location information must be posted at the worksite. Review N-3 of the Pesticide Safety Information Series and Section C2.20.1 – Medical Care.

(E) Respiratory Protection

Supervisors should inform employees when to wear a respirator and what kind of respirator is required during safety meetings. Review N-5 of the Pesticide Safety Information Series and Chapter 15 of the Caltrans Safety Manual for more information on respirator use.

(F) Specific Safety Procedures

The trainer shall advise all employees of specific safety procedures they should follow in handling, mixing and applying pesticides. Employees shall also receive training on the use of specific safety equipment required by pesticide labels. Employees have a right to know if any pesticides they use are on the “Prop 65 List.” Zero exposure equates to zero risk. As always, wear and care for personal protective equipment (PPE) that are provided. Review and post N-8 of the Pesticide Safety Information Series.

**(G) Hygiene**

Personal washing facilities are available at the work site, and should be used before eating or smoking, or in case of contact with the pesticide before leaving at the end of the work shift. Employees should be cautioned to not let safety awareness slip as the day progresses. When washing work clothes, avoid contaminating family clothing. Review N-7 of the Pesticide Safety Information Series.

Refer to Section C2.24: Proper Use and Handling of Pesticides.

**(H) Servicing Pesticide Equipment**

Employees who service pesticide equipment (including mechanics) shall be properly informed of the potential pesticide hazards and advised of the proper protective measures to employ while working on that equipment.

See Section C2.24.4: Preparing Pesticide Application Equipment for Repair.

**(I) Training Documentation**

In addition to recording of training in the Learning Management System (LMS), the trainer and the employee shall sign the Pesticide Safety Training Record at the completion of the training. One copy is given to the employee, one shall be kept in the employees work location, and one copy shall be sent to the District Landscape Specialist.

The Pesticide Safety Training shall cover all topics outlined in the “Pesticide Safety Information, N Series,” published by the California Department of Pesticide Regulation. Further, Series N-8 must be completed and posted at the work place where employees normally report to work.

**C2.24 Proper Use and Handling of Pesticides**

Pesticides shall always be used with care. The following guidelines for the use and handling of pesticides will help minimize the likelihood of injury to people and animals from exposure to such chemicals.

C2.24.1        Labels

Always read the pesticide label before using the products. Carefully read warnings and cautions before opening the container. Repeat this process every time, no matter how often a pesticide is used, or how familiar the directions are to the user.

C2.24.2        Pesticide Control Recommendation

A licensed Pesticide Control Advisor (PCA) is required to prepare a Pesticide Control Recommendation for each compound used. Pesticides shall be applied only in the areas and at the amounts and times specified in the Recommendation.

See Appendix C2-A: Caltrans Approved List of Herbicides and Appendix C2-B: Caltrans Approved List of Adjuvants.

C2.24.3        Safety Requirements in Loading and Using Pesticides

- (A) Personnel involved in spray operations shall be knowledgeable of the material(s), hazards, methods, and purpose of the particular operation. All pesticide applications should be supervised by someone holding a valid Qualified Applicator Certificate (QAC). Applications of all restricted materials must be supervised by someone holding a valid QAC.

See Section C2.17: Certification for Applicators of Restricted Materials.

“Supervision” does not mean the civil service rating of the person, but refers to the oversight control by someone who may or may not be present when the work is actually performed. Contact with the crew by the supervisor must be sufficiently frequent to assure adequate control of the work.

- (B) Protective clothing and proper eye and respiratory protection shall be worn as required by Caltrans policy and the label. Pesticides are more hazardous when in their concentrated form.

The Department of Pesticide Regulation (DPR) requires the mandatory use of gloves by pesticide handlers unless the label states that gloves are not to be worn. Pesticide labels may also require a specific glove type. Employees shall be provided clean gloves each workday. Clean gloves shall be either unused gloves or previously used gloves that have been thoroughly washed in soap and water (both inside and outside). DPR also requires eye protection as mandatory protection, even if not mentioned on the label. As a minimum, eye protection shall provide brow protection, including side shields. A face shield is acceptable eye protection and goggles are to be worn when mixing powders.

Refer to Maintenance Manual Volume 2 for Caltrans guidelines for label interpretation of protective clothing requirements.

- (C) Workers shall wear respiratory protection when required by the pesticide label. In addition to label and policy requirements, respiratory protection may become necessary due to the application method. Spray operations shall be discontinued or a respirator shall be used when spray mists cannot be eliminated from entering the breathing zone. Employees shall be medically evaluated, trained in the use of respiratory protection, and fit tested before they will be allowed to use a respirator.

Refer to Caltrans Safety Manual, Chapter 15: Respiratory Protection.

- (D) Workers shall attend training prior to handling pesticides. Training must be completed before the employee is allowed to handle pesticides and at least annually thereafter.

Refer to C2.23: Annual Pesticide Workers Safety Training.

- (E) Employees shall not smoke, eat, chew gum, use chewing tobacco or snuff when mixing or applying pesticides.
- (F) Employees shall never use their mouth to siphon liquids from containers or to blow out clogged lines or spray nozzles.
- (G) Pesticide applications must be confined to the target area. When weather conditions are not favorable and spray drift may move outside the target area, spray operations shall be discontinued immediately.
- (H) Spray operations are to be stopped immediately if there are any leaks in the equipment. This includes, but is not limited to, spray tanks, leaking hoses, or faulty connections.
- (I) Remove clothing immediately if contaminated with spilled pesticides.
- (J) If pesticide contaminates skin, wash the area thoroughly with cool water and soap. Follow the pesticide label directions for additional instructions.

#### **C2.24.4        Preparing Pesticide Application Equipment for Repair**

Prior to delivering pesticide equipment for repair to an equipment shop, vendor, or field mechanic, workers shall conduct the following decontamination and notification procedures:

- (A) Spray tanks shall be flushed with clean water and an appropriate cleaner to remove pesticide residue before servicing or repairing.

- (B) All pipes, hoses, screens, and other locations that may contain pesticides shall be thoroughly cleaned and flushed to prevent any pesticides from draining back into the spray tanks.
- (C) The supervisor responsible for delivering the equipment to the shop or field mechanic shall provide written information for the last pesticide used in the tank. As a minimum, the following shall be provided:
  - (1) Name of last material used;
  - (2) Recommended protective devices or equipment necessary; and
  - (3) Poisoning symptoms.

Equipment Service Center employees who may come into contact with pesticide residues should attend Pesticide Safety Training. Any person who works on pesticide application equipment is considered a pesticide handler. The Pesticide Safety Training is for their protection.

See “Pesticide Application Equipment,” Appendix C2-C at the end of this chapter.

### **C2.25 Considerations in Planning a Chemical Vegetation Control Program**

Prior to selecting a herbicide for vegetation control, alternative control methods should be considered and adopted if feasible, practical, and economically sound.

The success of a chemical vegetation control alternative is dependent upon a number of factors. The omission of any one factor can seriously affect the program.

See Section C2.08.1: Natural and Biological Controls.

If it is determined that chemical means of control are best for controlling vegetation, districts must carefully plan their programs. This section provides a list of considerations for planning chemical vegetation control.

#### **(A) Considerations in the Planning Stage**

Districts should consider the following when planning their chemical vegetation control programs:

- (1) Determination of the problem and the final desired result.
- (2) What types of vegetation need to be controlled.

- (3) The soil
  - (a) Types
  - (b) Slope grade in the target area.
- (4) The area's rainfall and climate.
- (5) Whether vegetation removal will be selective or non-selective.
- (6) Whether a goal is growth regulation rather than elimination of vegetation.
- (7) Determine if there is a need for fuel load reduction for fire prevention.
- (8) Characteristics of the target plants.
- (9) Adjacent land use.
- (10) Environmentally sensitive areas.
- (11) Stormwater concerns
- (B) Criteria for selection of herbicides used on highway right of way are, in order of importance:
  - (1) Safety
  - (2) Performance
  - (3) Economy
- (C) Timing of Application

Timing of application most often is a determining factor of final results. The timing depends on the type of herbicide used. The following lists basic considerations:

- (1) Application of a pre-emergent herbicide prior to germination of seed will prevent a vegetative cover. Most pre-emergent herbicides require soil moisture prior to application. Depending on existing vegetative cover, in some cases a post-emergent herbicide may need to be added to the tank mix.
- (2) If roots are wanted, but not a top growth, spraying is performed after germination when the vegetation is small enough to leave minimal fire hazards when dry.

- (3) Systemic herbicides must be applied when vegetation is actively growing and when foods are moving downward to the roots. This usually coincides with optimum soil moisture conditions.
- (4) Temperature and moisture dictate timing of application. Some herbicides require warm temperatures, others humidity, and some act only when the temperature is cool. Rain after application is required with some, whereas it would defeat the purpose with others.

Carefully follow label instructions and the instruction provided with the Pesticide Control Recommendation. Refer to the following Section C2.26: Selection of Herbicides.

## **C2.26 Selection of Herbicides**

### **C2.26.1 Contact Herbicides**

Contact herbicides may be used to control existing weeds within landscaped areas where a chemical soil treatment might not be desirable. Contact herbicides destroy the portions of plants on which they are sprayed. Their prime use is to destroy annual plants that will not grow from the roots when the top is dead.

They may be used to “knock down” or kill top growth on perennial plants, but the root system of perennials is not destroyed by single applications of contact sprays.

Contact herbicides may be used to control vegetation where a future roadside planting is anticipated since they leave no serious toxic residue. They may also be used for edging ground covers.

### **C2.26.2 Pre-emergent Herbicides**

Pre-emergent herbicide materials should be applied to the soil before the unwanted weed seeds germinate. They may be selective or nonselective in the plants they control. Most pre-emergent herbicides are best applied when there is soil moisture present, and require irrigation or rainfall soon after application to activate the herbicide and/or move it to the soil profile. Selective pre-emergent herbicides are useful for landscape and roadside applications, depending on desired results. Some pre-emergent materials may be used in varying quantities to produce either a selective or a non-selective result when applied.

Higher rates of these soil acting (pre-emergent) herbicides are used chiefly where no vegetative cover is desired. Fire prevention strips, under guardrails, signs, and delineators are examples of where non-selective herbicides would be used.

Pre-emergent soil acting herbicides are applied in liquid or granular form to the soil before the end of winter rains and before new vegetation has emerged. A suitable translocating herbicide may be added to the spray mix to control existing vegetation, or to control deep rooted perennial plants that are resistant to the pre-emergent herbicide.

A good VegCon Plan will alternate between different pre-emergent products every few years to reduce the tendency of weeds becoming resistant to specific herbicides.

#### **C2.26.3        Translocating Herbicides**

Translocating or systemic herbicides function by absorption through the foliage or root system of plants. The herbicide circulates to all plant parts, damaging cells or disrupting vital physiological functions within the plant leading to its demise.

Translocating herbicides are generally used to control perennial weeds, shrubs, and trees that may not be adequately controlled with other types of herbicides due to their extensive root systems.

Application rates are critical when using translocating herbicides. High concentration rates of herbicides can damage plant cells, shutting down plant physiology to the point that further products can no longer be absorbed by the plant.

#### **C2.26.4        Herbicide Combinations**

Herbicide combinations approved on their labels and the EIR can be used to remove multiple plant species in one spray application. For example, it may be possible to eliminate resistant perennials by combining low rate pre-emergent herbicides with translocating herbicides.

#### **C2.26.5        Growth Regulators**

Growth regulators are chemical formulations intended to physically alter the growth of plants.

Growth of shrubs, trees, ground covers, and other plants can be effectively controlled by use of these chemicals. This extends the periods between pruning, edging, or mowing.

Results are dependent on many factors such as plant material, location, weather conditions, time of year, and desired result. Consult label information of various products prior to use. Experiment with materials to determine their effects before general use.

#### C2.26.6 Chemical Brush Control

Growth regulators may be used to maintain brush at a desired size.

Use selective translocating herbicides to control new brush growth annually or when needed. Do not spray large vegetative woody brush material before mowing, leaving the material to become an unsightly fire hazard. Small regrowth under 12 inches in height may be sprayed without further removal.

Roadside brush may be effectively removed and controlled with chemical sprays. Brush which is more than one (1) foot in height should be cut and removed before spraying. The stumps may then be painted or sprayed with a “basal” treatment of glyphosate and triclopyr, or an alternate material registered for basal treatments. Any new shoots may be treated the following summer with a foliar translocating herbicide. Brush which is less than one (1) foot in height may be killed with foliar translocating herbicides. Roadside brush and small trees which are sprayed with translocating herbicides should be sprayed over their entire surface areas. Spraying a portion of such plants leaves an unsightly plant that is partly dead and partly alive.

See Section C2.27: Pesticide Spraying Operations.

#### C2.26.7 Adjuvants

Adjuvants are designed to alter the spray mixture to enhance the effectiveness of the herbicides. An example is one that increases herbicide effectiveness by reducing surface tension of the carrier and thereby providing greater contact of the chemical with the plant.

Some adjuvants buffer pH, provide penetration of waxy plant coatings, aid translocation, or alter the sticking ability of the solution. Others control evaporation, drift, or the release of the chemical in the solution.

Adjuvants are not added to some products by the manufacturer because they are not compatible with the herbicide in the container. In this case they must be combined just prior to use.

The amount of adjuvant to use is determined by the spray rate and volume. Carefully follow the PCA Recommendation. Not all of these materials act the same, so the proper material must be chosen for the specific job.

#### **C2.26.8 Chemical Injection Systems**

The 1,000-gallon spray truck with chemical injection system is considered standard equipment for roadside spray operations. Larger or smaller spray units with injection equipment will require special justification before being purchased. All Equipment Budget Requests (EBR's) for spray equipment will be approved by the Office of Roadside Maintenance before being purchased.

Chemical injection units should be used by crews that have large areas to be sprayed and large volumes of chemicals to use. This equipment provides the best control of spray rates and provides maximum flexibility for adjusting spray combinations.

Chemical injection units are very expensive to purchase, only perform as designed when kept clean and well maintained, and are operated by trained personnel.

#### **C2.27 Pesticide Spraying Operations**

Successful herbicide application depends on a number of factors including careful product selection, economy of the application (minimum acre rate necessary to control the target pest), timing of the application, environmental conditions (temperature, humidity, wind speed, and presence of an inversion), and soil conditions at the target site. Herbicide selection will also dictate other factors, such as application method, and whether adjuvants will be added. Specific to pre-emergent herbicides, irrigation or rainfall is a factor of when and where applications will be made.

Planning is required to ensure that spray operations are safe for the applicator, the support crew, and the traveling public. During spray operations, the applicator shall also consider the residual qualities of herbicides being used, constantly evaluating adjacent land use, and making conscious decisions during applications to avoid adversely impacting crops, livestock, and the environment. In addition, good planning must include proper rate and method of application to assure good results.

Care must be exercised in filling spray tanks and washing equipment to ensure that pesticides do not move off target and harm desirable plant and animal life, or cause environmental damage. Good stewardship shall always be foremost in the Caltrans IVM approach.

##### **(A) Pressure**

Common pressure for spraying of herbicides is 40 psi at the nozzle to avoid drift and turbulence. In some instances, pressures up to 200 psi may be used to obtain better coverage when spraying brush, cattails, Johnson grass and other large or dense growths.

**(B) Rate of Spray**

The rates of systemic or contact herbicides must be adjusted to compensate for the total leaf area when applied to dense stands of tall vegetation or brush. Perform periodic visual checks during the spray operation to ensure chemicals applied match the desired application rate per acre. The quantity of carrier must be sufficient for thorough wetting of the plants.

It is common practice to use varying rates of the active ingredient per acre, reflecting the density of foliage. For example, 100 gallons of spray may be required to thoroughly wet an acre of low grasses on which four (4) pounds of the active ingredient of an herbicide is required. An acre of taller grass, however, might require 300 gallons of mix containing 12 pounds of the active ingredient to cover the additional leaf area.

**(C) Adjuvants**

Adjuvants can increase herbicide effectiveness. They can decrease surface tension of the carrier allowing faster absorption of the chemical by the plant or they may increase the ability of the spray to adhere to the plant.

See Section C2.26.7: Adjuvants.

**(D) Travel Speed**

Herbicide effectiveness may be reduced if spray vehicle travel speed is not coordinated with the planned treatment rate, and if the pressure and nozzle size are not correct. Too much speed for the calculated rate and pressure could result in an ineffective application, while slower than calculated speed could result in over application.

Speed of travel, together with nozzle output, shall be calibrated to attain desired rate of application.

**(E) Nozzle output should be calibrated at least twice each working day. Because of the potential for wind drift caused by reduced droplet size, operators shall exercise extreme caution with the higher pressures.**

**(F) Agitation**

Equipment shall be adjusted to ensure proper agitation. Proper agitation within the spray tank prevents settling of suspended herbicidal materials and an ineffective spray operation.

- (G) Always check equipment for safe and proper operation prior to spraying. Equipment, including hoses and spray wands or guns, shall be cleaned prior to being used.
- (H) Pesticides shall be accurately measured to assure correct rate of use.
- (I) Wettable powders shall be premixed into a slurry form before adding to the spray tank.

### **C2.28 Guidelines for Ordering Pesticides**

Each district should keep an adequate supply of frequently used chemicals and allow for the time required to purchase additional material. This is not a blanket approval to warehouse excess quantities of chemicals. Order only what is needed, and specify delivery dates before the season of planned use. This will ensure timely delivery and eliminate warehousing large quantities for long periods of time.

Chemicals should be ordered in the largest containers practical to the operation. Materials purchased in drums are usually less costly per gallon than materials packaged in one (1) gallon containers. The problem of disposal of empty containers is reduced by the recyclable larger containers. Smaller containers may be justified if there will be economy of operation. Truck or carload lots of fertilizers are less expensive per ton when purchased in this quantity.

If no other product will do the job or if there are compatibility problems with other chemicals, this information shall be included with orders for chemicals to justify purchasing a specific material.

All pesticide purchases must be approved by the District Landscape Specialist in the district, or by the Maintenance Division, Office of Roadside Maintenance. There are a variety of purchasing methods to provide for quick receipt of material with a minimum of warehousing.

The following purchasing methods may be used:

#### **(A) Incidental Purchases**

Contract Delegation Purchase Orders (CDPOs) can be used for non-contract purchases up to \$24,999.99, before tax and freight (this amount may change - however the process will stay the same). Two quotations are required. Purchase Requests that limit the bidding to one brand or product must have a Sole Source/Limit To Brand Justification Form completed and attached to the file for documentation purposes.

**(B) Contracts**

Chemicals on State Contract may be ordered on a Contract Delegation Purchase Order without regard to monetary limitation.

**(C) Emergency Purchases**

If emergencies arise, chemicals exceeding \$24,999.99 may be purchased on a Contract/Delegation Purchase Order Form 42. Standard procedures for using the Form 42 emergency purchase process are to be followed.

Personnel not familiar with the emergency purchase process should contact the Office of Procurement and Contracts prior to calling vendors for bids.

As stated above, purchase requests that limit the bidding to one brand or product must have a Sole Source/Limit To Brand Justification Form completed and attached to the file for documentation purposes.

APPENDIX C2-A  
CALTRANS APPROVED CHEMICAL LIST

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**HERBICIDES**

bromacil  
cacodylic acid  
chlorsulfuron  
clethodim  
clopyralid  
dithiopyr  
glufosinate  
dichlobenil  
diglycolamine salt of dicamba  
dimethylamine salt of dicamba  
diquat  
diuron  
fluazifop-p-butyl  
flumioxazin  
glyphosate  
  
glyphosate & diquat  
halosulfuron-methyl  
imazapyr  
isoxaben  
magnesium chloride  
mefluidide  
monosodium acid methanearsonate  
napropamide  
norflurazon  
oryzalin  
oxadiazon

**BRAND NAMES**

Hyvar, Krovar 40%  
Montar  
Telar  
Envoy  
Transline, Lontrel T & O  
Dimension Ultra 40WP  
Finale  
Casoron  
Vanquish  
Banvel  
Reward  
Karmex, Direx, Diuron 80DF IVM  
Fusilade II T&O  
Payload  
Roundup Pro, Rodeo, Expedite, Glypro, Glypro plus,  
Touchdown Pro, Glygran, Razor Pro, Aquamaster  
QuikPRO  
Manage  
Stalker  
Gallery  
Killer  
Embark  
Weed-Hoe  
Devrinol  
Predict  
Surflan, Oryzalin 4Pro, Surflan A.S.  
Ronstar

**CALTRANS APPROVED CHEMICAL LIST**

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<b>oxyfluorfen</b>	GoalTender, Goal, Galigan 2E, Goal 2XL
<b>paclobutrazol</b>	Profile 2SC
<b>pelargonic acid</b>	Scythe
<b>pendimethalin</b>	Stomp, Pendulum, AquaCap
<b>prodiamine</b>	Endurance
<b>pronamide</b>	Kerb
<b>sethoxydim</b>	Poast

APPENDIX C2-B

Caltrans Approved Adjuvants List  
July 2003

Acidiphacant	Hi-Light Green
Activator 90	In-Place
41-A Drift Retardant	Magnify
Activator N.F.	Mark It Dyes (Green and Blue)
Agicide Activator	Mor-Act Adjuvant
Agridex	No Foam
Airex DC	No Foam A
Bivert	No Foam B
Blazon Blue	Para-Spread
Blazon E-Z	Penox
Buffer-X	Pro Herbicide Enhancer
Bullseye	Odor Mask
Chem-Trol	R-11 Spreader Activator
Choice,water cond.	R-56 Spreader Sticker
CMR Herbicide Activator	Spray Tech Oil
CMR Pesticide Equipment Cleaner	Sta-Put
CMR Spreader Sticker	Suspen-Der
Descend CA	Sylgard 309
Exact-Trol	Syl-Tac
38-F Drift Retardant	Target Pro-Spreader Activator
Foam Fighter	Tri-Fol
Hasten Spray Adjuvant	Tripleline Foam-Away
	Unifilm 707
	Unifilm NF
	Wex

July 2006

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**Appendix C2-C      PESTICIDE APPLICATION EQUIPMENT**

Before servicing or repairing this equipment, check the following:

C No. \_\_\_\_\_ ITEM No. \_\_\_\_\_

Cleaned and flushed on \_\_\_\_\_, by \_\_\_\_\_,

At \_\_\_\_\_ Maintenance Station.

The chemical(s) last used was \_\_\_\_\_

Toxicity Rating: CATEGORY I, II, or III (Circle One)

Maintenance employee delivering equipment to Shop \_\_\_\_\_

Maintenance Supervisor responsible for equipment \_\_\_\_\_

Telephone No. \_\_\_\_\_

Shop employee receiving equipment \_\_\_\_\_

Shop Supervisor of employee assigned to make repairs \_\_\_\_\_

Telephone No. \_\_\_\_\_

Observe the following precautions (from pesticide label):

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Poisoning Symptoms:

Weakness, headache, sweating, sick stomach and vomiting, uncontrollable drooling, pinpoint pupils that affect vision, dizziness, rapid heart rate, stomach cramps, diarrhea, difficulty in breathing, loss of ability to use muscles, loss of ability to control bowels, unconsciousness. The last four symptoms are seen only in advanced or severe cases of poisoning.

**If you experience any of the above symptoms, inform your supervisor and get medical assistance.**

Date released from Shop: \_\_\_\_\_ Repairs completed \_\_\_\_\_

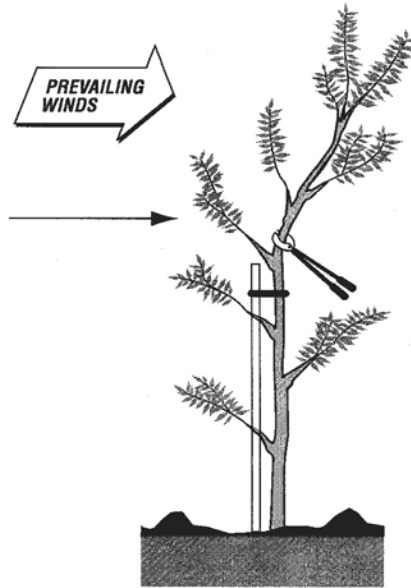
**Shop Mechanic** \_\_\_\_\_

APPENDIX C2-D

**TRIMMING YOUNG EUCALYPTUS TREES IN AREAS  
OF PREVAILING WINDS**

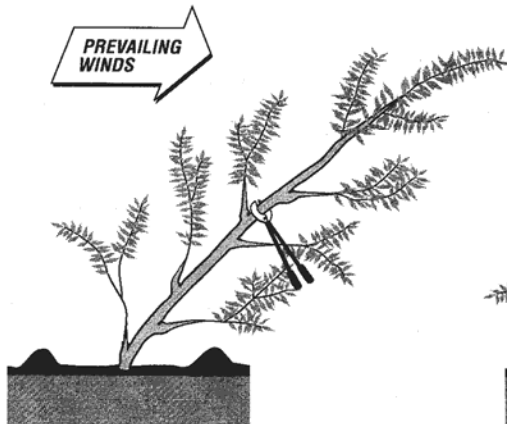
**TRUNK NOT AFFECTED**

If tree trunk is not affected,  
cut to an upright lateral.



**TRUNK IS AFFECTED**

If the tree trunk is affected, the tree can be  
brought to an upright position using the  
following steps:



Remove excess weight  
by cutting the tree to  
an upright lateral.

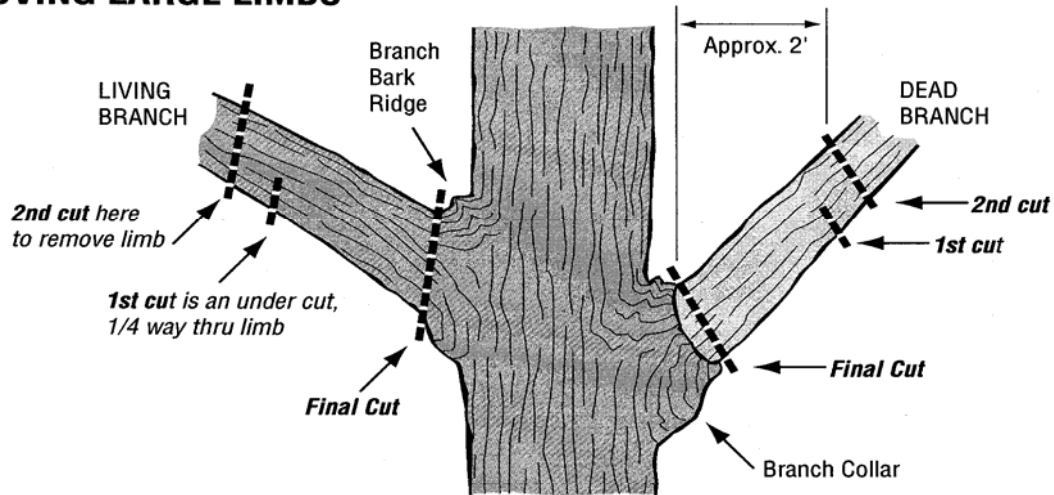


Straighten tree trunk  
when *soil is wet*  
and tamp well.



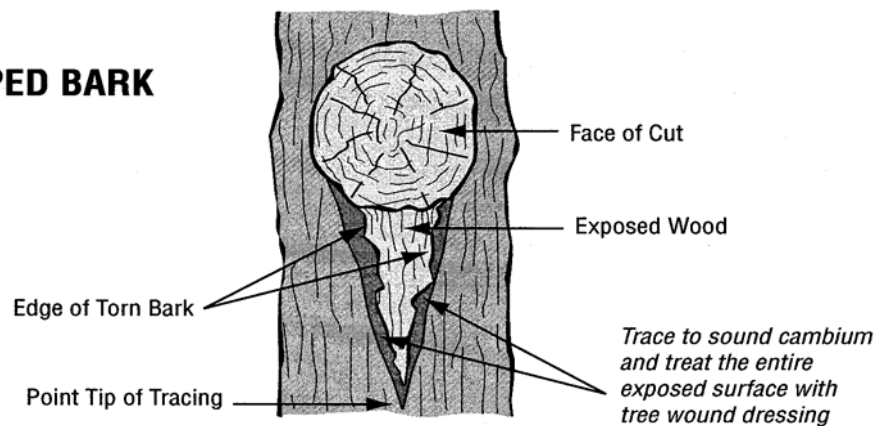
If the soil is unstable, sand  
or crushed rock may be  
added on the side toward  
which tree was leaning.

## REMOVING LARGE LIMBS



When removing a large tree limb, use the three-step process illustrated above in order to avoid bark injury. The same process is used on both dead and live limbs. A proper **final** cut begins just outside the branch bark ridge and angles down away from the trunk of the tree. Make the cut as close as possible to the trunk, but outside of the branch bark ridge and the branch collar, so that trunk tissue is not injured and the wound can seal in the shortest time possible. If the cut is too far from the trunk, leaving a branch stub, the branch tissue usually dies and woundwood forms from the trunk tissue. Wound closure is delayed because the woundwood must seal over the stub that was left.

## TREATING STRIPPED BARK

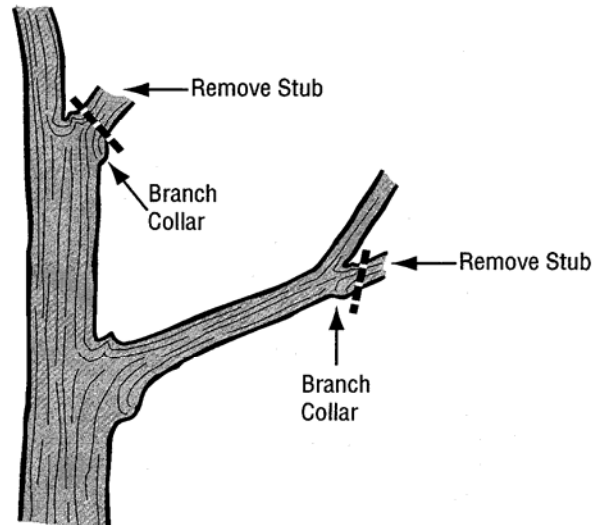


## METHODS USED IN TREE TRIMMING

### STUBS:

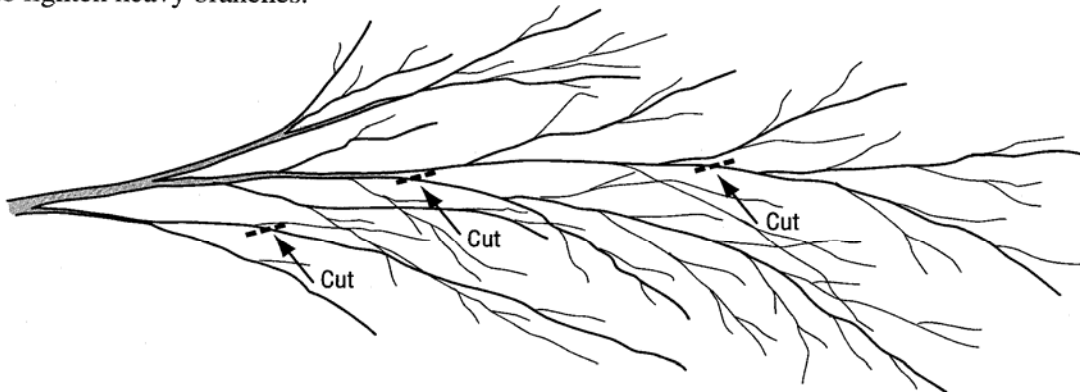
When removing to a leader or lateral, make the cut at the same angle or direction of growth of the remaining portion of the tree.

Avoid injury to the branch collar.



### HEAVY BRANCHES:

Remove growth from under limbs to lighten heavy branches.



# **CHAPTER C5**

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## **C5.00 Introduction**

This chapter is divided into four sections:

- Section 1 : Unpaved Shoulders
- Section 2 : Fences
- Section 3 : Drainage and Miscellaneous Facilities
- Section 4 : Other Roadside Appurtenances

Some of the topics included in this chapter are discussed elsewhere in this manual. For example, Section I builds on the information included in Chapters A and B. Where appropriate, there will be references to other chapters.

## **Section 1: Unpaved Shoulders**

### **C5.01 General**

Unpaved shoulders are that portion of the right of way bordering the traveled way, and may be constructed either of native or imported material. Unpaved shoulders may be adjacent to inside or outside lanes, and provide the same function as paved shoulders. Unpaved shoulders may either be part of the original design of the highway, or may have come into existence through usage.

Shoulders should slope away from the pavement at a 5 percent gradient, except on the outside of super-elevated curves or other special sections. Replace native material with imported material where maintaining lateral support of pavement edges is a recurring problem.

Where native material is unsatisfactory and is being replaced, refer to the Standard Specification Plans (SSP) 19-7.02 for shoulder backing material.

### **C5.02 Policy**

#### **(A) Type and Frequency of Maintenance**

The maintenance measures to be taken and the frequency of their use should largely be determined by the amount of traffic, general pavement condition, time of year, and the structural materials. Diked sections of shoulders require less frequent unpaved shoulder maintenance.

**(B) Lateral Support**

Lateral support of the pavement edge is an important maintenance consideration for protection of pavement integrity. When the support has diminished to approximately one-half the pavement thickness it should be scheduled for repair. Loss of lateral support is more critical for narrow paved shoulders than for wider shoulders due to distribution of loads relative to the edge of the pavement.

**(C) Unsurfaced Areas**

The above requirements for lateral support also apply to unsurfaced areas abutting the traveled way or paved shoulders. In addition, these unsurfaced areas should be relatively free of ruts and properly sloped. This ensures adequate drainage and provides room for disabled vehicles.

Shoulder blading is not a satisfactory method of vegetation control. Excessive blading can cause undesirable air and water quality problems.

**(D) Safety Considerations**

Shoulder operations should be conducted only on one side of the highway at a time. Refer to the appropriate Maintenance Codes of Safe Operating Practices.

Loss of lateral support greater than two inches may adversely affect an errant vehicle's ability to return safely to the travelway.

**(E) Need for Drainage**

Drainage should be maintained to eliminate ponding near the edge of shoulder.

## **Section 2: Fences**

### **C5.03 General**

Fences are divided into three categories:

(A) Freeway Fences and Right of Way Fences

Freeway fences and right of way fences are State owned and act as physical barriers to ensure integrity of access lines or right of way lines. As a secondary function, these fences may act as a property fence. All freeway and right of way fences are placed either on the access line, or immediately adjacent to the right of way line.

(B) Property Fences

These are privately owned fences outside the right of way that serve the abutting property owners' needs. Although they are the property of the abutting owner, such fences may serve access control purposes. The State provides property fences only as a right of way consideration and does not maintain them unless the condition of the fence poses a hazard.

(C) Median Fences

Median fences prevent indiscriminate crossings of the median by vehicles or pedestrians.

### **C5.04 Policy**

State owned fences are provided to delineate right of way, control access, and prevent indiscriminate crossing of medians or ramps by vehicles or pedestrians.

State owned fences should be maintained in condition to serve their intended purposes.

State owned fences should be repaired when they are damaged to the extent that the physical barrier effect is lost or severely reduced. Owners of private property fences should be promptly notified when their fences are in need of repair in order to protect the highway user.

In case of damage that destroys the barrier effect of private fences or walls controlling State-owned access, take action to restore the barrier effect. The property owner should be notified promptly of the damage and encouraged to make permanent repairs.

### **C5.05 Types of Fence**

The following are the standard fences used by Caltrans Maintenance:

- (A) Type BW: Five strands of barbed wire on either wood or metal posts.
- (B) Type WM: Wire Mesh with three strands of barbed wire at the top, on wood or metal posts.
- (C) Type CL4: Chain Link fencing 48 inches high on metal posts.
- (D) Type CL6: Chain Link fencing 72 inches high on metal posts.

Type BW or WM fencing are normally used in rural areas. However, either BW or WM fencing may be placed in urban areas where natural barriers or other conditions are such that this fencing will afford the same access protection as chain link fencing.

Chain Link Fences (Type CL) are generally used in urban or developed areas. Chain link fences along the right of way line and in the outer separation shall be six (6) feet high.

Exceptions to the 6-foot height will be allowed along the right of way where isolated improvements exist, and a lower fence will be in keeping with the height of adjacent property fences. At these locations, the four (4) foot chain link fence may be installed.

When required, a 4-foot high chain link fence, raised 6 inches off the ground may be used in a median.

### **C5.06 Maintenance of Fences**

State owned highway fences shall be maintained by the Department. Property fences are maintained by the adjoining owner. It may be necessary to check the Superintendent's copy of "As Built" plans, right of way agreements, or actually measure on the ground to establish the location and ownership of fences. The Caltrans Permits office may also be a source in determining the location of property fence lines.

### **C5.07    Repairing Chain Link Fence**

The standard for chain link mesh can be found in Standard Specification section 80-4.01B. However, mesh design varies by manufacturer, and the Standard Specification for chain link mesh allows for variance. For example, a 72-inch height chain link fence from one manufacturer will have 21 and 1/2 vertical meshes; other manufacturers will have 22 and 1/2 meshes. Manufacturers also use different types of weaving. Some prefer a right-hand weave, while other companies use a left-hand weave.

Chain link fencing carried in the warehouse will vary in the number of meshes and right and left hand weave, depending upon which manufacturer is awarded the purchase order. Fence material ordered from stock may not always match the existing fencing.

New fencing material may be joined or spliced with an existing fence by inserting a seven-gauge tension wire of sufficient length through the alternate meshes vertically. This method may be used in joining fencing having either right to left, right to right, or left to left mesh, or of a different number of meshes to the height.

When joining fencing having an unequal number of meshes per height, it will be necessary to cut the wire in one diamond at a point where the wires will not mesh.

### **Section 3: Drainage and Miscellaneous Facilities**

#### **C5.08 General**

This chapter covers the repair, replacement and cleaning of ditches, culverts, under drains, down drains, horizontal drains, headwalls, debris racks, bank and shore protection and miscellaneous drainage features. Also included are sections on drift removal, bench cleaning, slide removal, fill slope replacement, repairs or replacement of retaining walls, sidewalks and curbs, bins, cattle guards and other minor structures.

#### **C5.09 Applicable Law**

The following code sections apply to drainage:

- (A) Damage to Highway by Water 588 Penal Code: 725 Streets and Highway Code.
- (B) Drainage or Impounding of Water, 725 - 729 Streets and Highway Code.
- (C) Water, 725 - 727 Streets and Highway Code.

#### **C5.10 Inspections**

Inspections and monitoring required by the Facilities Pollution Prevention Plan (FPPP), the Maintenance Activities Pollution Prevention Plan (MAPPP), and corresponding corrective actions taken as a result of the implementation of these plans are covered in Chapter "F" of this manual.

##### **C5.10.1 Inspections by District Maintenance Supervisors**

Visual, surface level inspections of drainage facilities shall be made by District Maintenance Supervisors to identify obvious defects, hazards or potential problems, and also to monitor known problems. These inspections should be made annually and during and after each major storm. The purpose of these inspections is to supplement the more detailed, but less frequent, inspections by the District Culvert Inspection Program (for those districts that have this program).

When major defects or hazards are found, they shall be immediately reported to the District Culvert Inspection Program or Maintenance Engineer. If an emergency condition exists, appropriate action shall be taken as soon as possible to ensure the safety of the traveling public and to prevent further damage from occurring, including restricting traffic on the roadway or closing it completely, installing temporary drainage or support systems, making temporary repairs, etc.

#### **C5.10.2          Inspections by District Culvert Inspection Program**

Many districts have either created or are in the process of establishing a Culvert Inspection Program, coordinated by Headquarters. The District Culvert Inspection Program accomplishes the following:

- Identifies and establishes a statewide inventory of all drainage facilities, including site location, design information, and deficiencies, which is used to establish the statewide inventory.
- Thoroughly evaluates condition and identifies deficiencies at early stages where corrective maintenance strategies will be effective, or prevent failure from occurring, which has worker and public safety impacts.
- The strategy and frequency for inspections will rely on a priority system based on route classification, Average Daily Traffic, culvert age and size, material type, and site conditions.
- Initiates a process for commencing corrective maintenance projects and regular programming of rehabilitation and replacement culvert projects to avoid future catastrophic culvert failure. This process is similar to the inspection, repair, and rehabilitation process for the highway system bridges, whereby the inspection process is the precursor of all bridgework, effectively preventing bridge failure.
- Improves the understanding of the mechanisms leading to culvert failure, and will potentially lead to changes in design specifications, construction methods, and/or materials for improved culvert performance.
- Improves workforce expertise and ability for quick response to emergency situations involving culverts.

Inspections may be performed by visual, “walk-through” inspections for larger culverts, or by the use of remote video inspection equipment for smaller culverts or culverts with limited accessibility. Ideal inspection teams consist of at least one engineer and one field Maintenance worker qualified to operate and maintain the remote video inspection equipment. Additional team members may be required for confined space or other safety requirements. See Appendix B of the Code of Safe Operating Practices for confined space entry procedures.

### **C5.11 Culverts**

Culverts are defined as closed conduits that allow water to pass, but do not meet the criteria for bridges. See Section H.05 of this manual for the definition of a bridge. Culverts should be kept open and in a state of good repair.

Damage that impairs the structural integrity of the culvert should be repaired immediately.

Culverts should be cleaned of sediments when they are no longer able to function properly. See Chapter “F” of this manual for additional storm water cleaning requirements.

Channels should have sufficient depth and grade to ensure drainage to and from culverts, from the roadway, and from other roadside areas. Scoured areas that potentially compromise the structural integrity of the culvert or pavement should be corrected. Drainage grates should be maintained free of debris.

#### **C5.11.1 Record of Culvert Performance**

Performance data in regard to the more important culverts should be recorded after major storms and while evidence of flood stage elevations are clearly observable. The height of drift above invert near the outlet and inlet of the culvert should be noted after the storm. The condition of the culvert should be checked as soon after the storm as possible noting abrasion, pitting, rust, rivets, spalling, exposed reinforcing, cracks, joint openings, drift and detritus in barrel. Scour and erosion should be noted at both inlets and outlets. Erosion of channel banks downstream should be observed. Erosion and undercutting of slope protection near a culvert should be noted.

In addition, each District Culvert Inspection Program should update and maintain a database that includes inventory, condition, and recommended repair strategies for any deficiencies. This database shall be maintained in close coordination with Headquarters.

### **C5.11.2 Culvert Installation**

Culverts shall be installed as set forth in the appropriate sections of the Standard Specifications and Standard Plans. A geotechnical investigation is warranted when significant perforations exist, if there is loss of soil around the pipe, or if there are slope failures or depressions apparent above the pipe,.

Where traffic or other conditions warrant, half width construction may be permitted. If conditions do not permit open trench construction, it may be necessary to jack pipe through the embankment.

If the inverts of metal pipe installations are worn to the extent requiring repair or replacement, consider the following courses of action (It is recommended to consult with the Maintenance Engineer or district hydraulic section prior to altering any culvert material type or size):

- (A) If the remainder of the barrel is in good condition the pipe may be relined with mesh reinforced concrete.
- (B) Insert and seal a smaller diameter pipe inside the original pipe if hydraulic requirements permit.
- (C) If the existing culvert appears to be inadequate, replacement with large pipe should be referred to district hydraulic section (Maintenance Engineer may assist). There are numerous issues that could involve right-of-way, increased flows, erosion, or other aspects, which should be studied before a culvert is increased in size.

### **C5.12 Ditches and Gutters**

Ditches and gutters should be inspected periodically and maintained to permit free flow. Lined ditches and gutters should be sealed or repaired to maintain structural integrity.

### **C5.13 Drainage Channels and Shorelines**

Highway facilities are susceptible to damage from heavy flows of water, and protective devices are provided for many facilities such as riprap, slope paving, gabions, walls, vegetation or other devices. It is essential that these devices be maintained to ensure proper function. Refer to the Bank and Shore Protection section of the Highway Design Manual for further information.

Protective devices near water channels and shorelines should be checked periodically to detect conditions that may cause scour, undermining, washout, or other damage to the highway or facilities by water or wave action. Deficiencies that endanger highway facilities should be repaired promptly. Temporary repairs often are necessary until permanent repairs can be scheduled. Consult the District Hydraulics Unit for assistance with repairs that require significant effort.

Repair or correction of deficiencies not having an immediate effect on the structural integrity of highway facilities should be coordinated with routine maintenance operations. Work in channels should be coordinated with the local offices of State and federal regulatory agencies.

#### **C5.14 Under Drains, Horizontal Drains and Down Drains**

Under drains (including underground groundwater relief systems, horizontal drains-cut slope groundwater drains, and down drains), surface drainage conduits, and accompanying collector systems should be inspected once a year and cleaned or repaired as necessary to ensure free flow.

Surface water should not be permitted to discharge into an under drain.

#### **C5.15 Edge Drains**

Properly installed and maintained pavement edge drains can help ensure long pavement life.

Edge drains should be inspected early in the winter season to assure that they are functioning.

Inspect during or shortly after a rainstorm to observe the flow. If a drain appears to be clogged, it may be checked with a "snake" and cleaned by water jet equipment if necessary. Clean outs have been installed for this purpose. See Chapter "F" of this manual for any storm water related restrictions to cleaning.

Inspections make sure the wire mesh cover at the end of clean outs and outlets are not damaged. Damaged mesh might allow access to rodents who can build nests in these drains and block flow of sub-surface water.

#### **C5.16 Structure Drainage Systems**

Bridge drainage systems should be inspected annually prior to the rainy season, and cleaned where necessary. These systems should be observed during storms to ensure proper functioning.

### **C5.17 Minimum Thickness of Cover**

The table below provides the minimum thickness of cover measured at the edge of travel way required for design purposes over pipes and pipe arches. For construction purposes, a minimum cover of six (6) inches greater than the thickness of the structural cross section is desirable for all types of pipes.

Class 4 concrete backfill may be used for culverts where it is necessary to have less than two (2) feet of cover below the top of a flexible pavement. A minimum of six (6) inches of concrete backfill should be used on each side of culverts up to 42 inches in diameter; and, a minimum of one (1) foot of concrete backfill should be used on each side of culverts over 42 inches in diameter.

Surface type	Corrugated metal pipes and pipe-arches	<b>Minimum Thickness of Cover</b>	
		Structural plate pipes and pipe-arches	Reinforced concrete pipes
Flexible pavements or unpaved	Diameter or span/ 5 Or 2 ft. minimum	Diameter or span/ 8 Or 2 ft. minimum	2 ft. minimum
Rigid pavements	Diameter or span/ 5 Or 1.2 ft. minimum	Diameter or span/ 8 Or 1.2 ft. minimum	1 ft. minimum

Figure C5-1: Minimum Thickness of Cover for Culverts

### **C5.18 Jacking and Boring Pipe**

Reinforced concrete pipe (RCP) and welded steel pipe may be installed by jacking or boring through the embankment / fill. There are also specialty pipe types that are useful for jacking, and approval for use of specialty pipes can be obtained from the Headquarters Hydraulic Engineer.

Usually, pipe that is 30 to 60 inches in diameter is the size for installation by jacking. As the jacking operation progresses, material is hand excavated, or sluiced from inside the pipe.

Pipe smaller than 36 inches in diameter may be installed in a similar manner by boring. In this case, material is excavated from inside the pipe with a mechanical earth auger.

Obstructions in the fill such as boulders, rocks or utility lines may make this method impractical.

### **C5.19 Private Irrigation Facilities**

Where cross pipes or siphons are installed for the purpose of conveying irrigation water, maintenance of the installation may be the responsibility of the abutting property owners or others. Check right of way contracts and encroachment permits for conditions regarding such culvert installations to determine Maintenance responsibility. Note any instances of illicit connections or illegal discharges as outlined in Chapter "F" of this manual.

### **C5.20 Entry Upon Private Property**

Conditions may require that employees enter upon private property to maintain and repair drainage culverts or other structures or appurtenances within the State highway right of way.

A legal opinion on this subject states that except in cases of emergency, "Before entering upon private property to maintain or repair culverts, or other structures, or appurtenances, employees should obtain the property owner's consent whenever practical, and in no event should employees ever enter private property after an owner thereof has expressed opposition to such entry."

If entry is denied but is necessary, contact the Deputy District Director, Maintenance. He or she may determine that legal assistance is necessary.

Consent to enter upon private land may be obtained by a simple document such as the following:

<p>Date -----</p> <p>I hereby grant permission to the State of California and its authorized employees to enter upon only so much of my property as may be necessary to maintain and repair drainage culverts, or other structures or appurtenances, located within the highway right-of-way.</p> <p>This permission shall continue in effect until revoked by me or my successors.</p> <p>_____</p> <p>(Signature)</p>
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Figure C5-2: Right of Entry Request

### **C5.21 Maintenance of Over Side Drains and Slope Ditches**

Pipe or flume down drains, paved spillways, and slope ditches are provided to convey water from the embankment or slope.

Structures of this type should be maintained intact, and in the case of metal assemblies, maintained in tight contact with shoulder surfacing, side ditch lining, and dike paving. If embankment settlement occurs, restore to grade, and re-establish down drains or spillway, side ditch and dike.

Fill and seal cracks around inlets of down drains and seal paved spillways to prevent seepage of water into embankment areas.

If RSP is provided at the end of down drains or paved spillways, they should also be inspected and repaired if needed.

### **C5.22 Under Drains**

Under drains serve to intercept ground water before it reaches the subgrade. Perforated pipes that may be steel, aluminum, plastic, galvanized corrugated metal or tile are used for this purpose.

Local conditions will determine whether the installation should be along the shoulder line or toe of slope or a herringbone system under the traveled way.

The minimum diameter of pipe to be used is six (6) inches. Place perforated metal pipe with perforations down. Invert grade of pipe should be at least three (3) feet below surface. A grade of at least 0.5 percent should be used if possible; however, if this slope is unobtainable grades of 0.20 percent for laterals, and 0.25 percent for mains may be established.

Refer to Standard Specifications and Standard Plan D102 for methods of placing pipe, filter material and grading of filter material. Stabilize soft or mucky trench bottoms by tamping in straw or add sufficient granular material to stiffen the muck.

Surface drainage should not be permitted to discharge into an under drain. Clean outlets of under drains to maintain flow of water.

### **C5.23 Horizontal Drains**

Subsurface water is frequently a primary cause of landslides or slip outs that may close or impair the use of the road. Landslides can sometimes be prevented or controlled through installation of horizontal drains, by themselves or in combination with other treatment.

Horizontal drains consist of perforated metal pipes or PVC pipes (see Standard Specifications, Section 68-2) installed in holes drilled on a slight gradient into fill, cut or natural slopes. Perforated two (2) inch iron pipe is normally used for casing. It is usually necessary to provide a suitable collection system to remove the intercepted water from the area.

Horizontal drains will lose their effectiveness unless properly maintained. The drains require periodic cleaning, and the collection system must be kept in repair. The Caltrans Transportation Laboratory (Translab) can recondition horizontal drains. Translab will also perform condition surveys on request.

### **C5.24 Dry Fords**

Stream fords may be provided on minor highways at watercourses subject to flash floods.

Culverts carry the normal flow and paved dips with cutoff walls or slope paving on either side carry the overflow. Keep culverts clean and dip surfacing intact and sealed. Repair and support undercut walls or slope paving.

### **C5.25 Bank and Slope Protection**

Protective measures may be required where a stream flow or wave action endangers highway embankments or structures and even private property. Erosion may be controlled through a variety of methods, as provided in this section.

The type of protection should be chosen so as to maintain the location and natural roughness of the bank, making optimum use of local material. The velocity of flow and direction of currents are very critical factors in selecting the material. Consult with district hydraulic section for assistance in selecting the appropriate type and location and depth of placement for the bank or slope protection.

During emergencies, rock may be deposited along the bank for erosion control. Sandbags and weighted canvas or plastic sheets may also be used. Dumping tree trunks or stumps along a bank to control erosion is not advised, since this material may float out on subsequent storms and endanger downstream bridges or structures. Planting willows along an overflow bank may aid in controlling erosion by reducing the velocity of flow, but the possibility of the willows being scoured out and becoming damaging drift should be considered.

Dikes may be constructed to direct water away from a fill or bridge abutment, but may cause erosion of private property. Dikes or other obstructions that cause abrupt change in current should be avoided.

If bank or slope protection or stream control devices extend beyond the right of way, right of entry should be obtained before making repairs. See Section C5.20: Entry Upon Private Property.

Bank and slope protection devices are generally broken down into two categories: armor protection and training systems.

#### C5.25.1 Bank Protection

Armor protection, which includes rock slope protection, PCC grouted rock slope protection, concrete slope paving, sacked concrete slope protection, fabric formed slope protection, and gabions is the artificial surfacing of bend, banks, shore or embankment to resist erosion or scour. These devices may be flexible or rigid. A discussion of some of the common types of armor protection follows; see Highway Design Manual, Section 873.3 for specific details.

##### (A) Rock Slope Protection (RSP) or Riprap

Rock slope protection is flexible, easily repaired and has the ability to resist heavy impact from drift and debris. The toe should be below depth of scour. The size of rock should be based on the velocity of flow and depth of scour. Refer to Standard Specifications for size and quality and to the report “California Bank and Shore Rock Slope Protection Design – Practitioner’s Guide and Field Evaluations of Riprap Methods” for design and method of placement. The report can be found at the following website: [www.dot.ca.gov/hq/oppd/hydrology/hydroidx.htm](http://www.dot.ca.gov/hq/oppd/hydrology/hydroidx.htm). Filter fabric may be required for the RSP to function properly.

Slope protection damaged or displaced should be replaced after each storm, as conditions warrant. In an emergency with damage continuing, repairs may be made with heavier unclassified rocky material. Additional information on emergency repair procedures using RSP are available from the Headquarters Hydraulic Engineer. Rock that is dumped into place (Method B Placement) must be larger than rock placed by Method A, which required a three point bearing placement.

**(B) PCC Grouted Rock Slope Protection**

This type of protection consists of rock slope protection having voids filled with portland concrete cement (PCC) grout to form a solid armor. It has application in areas where rock of sufficient size for ordinary rock slope protection is not economically available. Grouting not only protects the rock system from the full force of high velocity water, but also integrates a greater mass to resist its pressure. Grouting will usually increase the cost per unit volume of rock.

This type of protection is rigid without high strength and requires support by embankment. Prevention of undermining is important. Grout penetration should be 18 inches for 1/2 ton rock varying to six (6) inches for cobbles.

It should not be used on slopes steeper than 1 1/2:1. The grout should be placed in voids that do not have fine material that will hinder the penetration of the grout. The depth of grout penetration is shown in "California Bank and Shore Rock Slope Protection Design – Practitioner's Guide and Field Evaluations of Riprap Methods" which can be found at the following website:

[www.dot.ca.gov/hq/oppd/hydrology/hydroidx.htm](http://www.dot.ca.gov/hq/oppd/hydrology/hydroidx.htm).

PCC grouted RSP needs to include weep tubes to allow for passage of water than can build up in the soil on the bank of the revetment. Extra precaution should be observed to construct the toe of grouted slope protection on solid rock or below the depth of scour. A gravity cut-off wall at the toe of the slope protection may be required. The rougher the surface the better the protection serves. Ends should be protected by tying into solid rock or forming smooth transitions with embankment subjected to lower velocities. If the embankment material is exposed at the top, freeboard is warranted to prevent overtopping.

**(C) Concrete Slope Paving**

This rigid type of slope protection composed of concrete reinforced with wire mesh is used only where flow is controlled and will not over-top the protection. It may be damaged by undermining hydrostatic pressure and material being washed through cracks. If degrading of stream or scour expose the toe, the toe should be protected with heavy rock, grouted rock, or concrete cut-off wall. The cost of concrete slope paving is high on a cubic meter basis but generally less, on the basis of area, than for sacked concrete slope protection.

Weep holes should be placed in the slope paving if there is a possibility of water seeping behind the paving. They may be placed by drilling a hole in the slope paving, placing rock behind the paving, and grouting a section of pipe in place. If cracks develop of sufficient size to permit the backing material to wash out, they should be sealed with concrete grout.

**(D) Sacked Concrete Slope Protection**

The Sacked Concrete Slope Protection (SCSP) method is no longer a Caltrans standard design, and should only be used for replacement in kind, where repairs of existing slopes that already have SCSP are needed. To facilitate such repair work, please refer to the developed plan at <http://pd/design/drainage.asp>.

This method of protection consists of facing the embankment with sacks filled with concrete. The toe should be below anticipated scour. The strength depends on the embankment that should be well compacted. Placing of the sacks usually leaves sufficient voids so hydrostatic pressure is not built up behind the sacks. Sacks should be placed high enough to avoid overtopping.

A lot of hand labor is required, but it is simple to construct and adaptable to almost any embankment contour. The installation must depend upon the stability of the embankment for support, and should not be placed on slopes steeper than the angle of repose. 1 1/2:1 slopes are preferred, but 1:1 have been used safely. The cost is usually more than the cost of rock for equal protection against velocity of flow, and is used primarily where stream gravel is available, and satisfactory rock is not economical.

Almost all failures of sacked concrete are a result of stream water eroding the embankment material from the bottom, the top, or the ends. If the ends are not tied into rock or other non-erosive material, cutoff returns are to be provided, and if the protection is long, cutoff stubs are used at intervals and at ends in order to prevent or retard a progressive failure.

Dry pack placement can be applied by spraying the surface with the water. Dowels have been driven into the wet sacks in place to add extra strength.

**(E) Fabric Formed Protection**

Fabric formed protection uses sectionalized fabric mattresses filled with a fine aggregate concrete.

The protection is formed by using a double-layered envelope of nylon or other suitable synthetic fabric that is laid on the area to be protected, and then filled by pumping a fine aggregate concrete into the mat. It is relatively easy to place, and may be installed in the dry or under water. It is a relatively cost effective alternative to conventional slope paving methods.

Hydrostatic uplift pressure is relieved through filter points or plastic weep tubes inserted through the mat. A filter fabric is used under the mat when relief of hydrostatic pressure is necessary.

**(F) Gabions**

Gabions consist of baskets fabricated from rectangular wire mesh filled with rock or cobbles (size and grade designated by district Lab or hydraulic sections). Multiple baskets are connected together as a unit and well anchored.

Gabions are useful where the only rock economically available is too small to be used as RSP. They are subject to damage by salt air and streams carrying gravel and stones which would erode the wire mesh. Like RSP, gabions may require filter fabric.

Flexible rock and gabions, properly anchored, may be used to protect against severe scour, especially at the base of concrete slope paving or sacked concrete slope paving. If undercut, the toe of the mat tends to adjust itself to the scoured section and retards further undermining.

Economy of use is governed by availability of selected rock filling and likelihood of corrosion of the galvanized wire mesh.

C5.25.2      Training Systems

Training systems are structures, usually within a channel, that act as countermeasures to control the direction, velocity, or depth of flowing water. They are broken down into three categories: retards, jetties, and baffles. Permeability is the most important property of a training system. An impermeable system may deflect the stream flow entirely, whereas a permeable structure may serve mainly to reduce the strength of water velocity or current. A discussion of some of the common types of training systems follows; see Highway Design Manual, Section 873.4 for specific details.

(A)   Retards and Permeable Jetties

Retards and permeable jetties are extensive or multiple unit structures composed of similar open forms like piling, fencing and unit frames. They are dissimilar in function and alignment, with retards being parallel and jetties being oblique to the embankment. Retards are milder remedies than jetties.

Retards lessen the velocity along the embankment, preventing erosion or scour to its toe. They may be used in conjunction with other slope protection methods, or to encourage deposition of waterborne material between the retard and the bank or induce vegetation growth along the bank. They may be used to slow the flow on one side of the channel or discourage a stream from meandering.

Permeable jetties are elongated, artificial obstructions projecting into a stream from the bank to control shoaling and scour by deflection or redirection of currents. The permeability allows for some flow through the structure to minimize the formation of eddies immediately downstream.

Maintenance of such structures is confined primarily to the replacement of stone fill, if used.

(B)   Groin

A groin is a solid or permeable and relatively slender barrier opposing the natural flow of water to control the movement of bed material. It may be built of stone, concrete, steel piling or timber piling.

(C) Baffle

A baffle is a pier, fence, wall, or mound built on the bed of a stream to control, deflect, check or disturb the flow. Baffles may vary in magnitude from a check dam on a small stream to a system of training dikes or permeable jetties for deflecting or directing flow. A potential drawback to installing a baffle is the possibility of erosion to previously unexposed areas, threat to adjacent property, eddy currents, and possibility of scour.

Drop structures or check dams are effective for gradient control, and are most suited to locations where bed materials are relatively impervious; otherwise, underflow must be prevented by cutoff walls.

C5.25.3        Tetrahedrons

Tetrahedrons constructed of steel rails are limited to use in broad stream channels where the slight restriction effected by the tetrahedrons will not appreciably increase stream velocity, or across embayments which have developed in recent floods. This permeable type of protection tends to reduce stream velocity adjacent to the embankment and promotes deposition of material.

C5.25.4        Jackstraws

Jackstraws, usually constructed of railroad rails, are not recommended for general use, but may be resorted to in emergency as a control measure, at critical locations.

C5.25.5        Fence Type Protection

Wire mesh fences, constructed either with steel rail or pipe, may be used to confine streams of moderate flow within definite channels or to protect embankment slopes, which are subject to erosion by high water. This type of protection consists of a single or double line of posts and wire mesh, between which is formed a wire mesh basket filled with brush and rocks. Fences should be well anchored to prevent overturning.

As the wire basket settles due to scouring action or compaction of filler material, additional brush and rock may be added to maintain the effectiveness of the structure.

See Section 2 of this Chapter: Fences, for details of rail and wire fence construction.

**C5.25.6          Control of Ditch Erosion**

Excessive erosion in drainage ditches may be controlled by applying asphalt concrete or premix material, loose cobbles or grouting rock, and by constructing check dams. Sausage rolls of chicken wire filled with small rock are effective.

Where water ponds on shoulder areas, provide additional drainage by cutting dikes and installing over side drains. Prevent slope erosion by paving outlet ditches on flat slopes or by using pipes or flumes on steep slopes.

Consult with the District Hydraulic Engineer for assistance with the design when using these measures.

## **Section 4: Other Roadside Appurtenances**

### **C5.26 General**

This section discusses appurtenances located throughout roadsides. It does not include electrical roadside appurtenances, nor those associated with pedestrians.

### **C5.27 Benches**

Bench areas in slope areas should be physically inspected as needed. Accessible benches should be cleaned when drainage is operationally impaired.

### **C5.28 Curbs and Curbed Islands**

These facilities provide one or more of the following functions: Control drainage, separate vehicles from pedestrians, channelize traffic, or provide pedestrian refuge.

When curbs fail to perform their function due to settlement, heave, or damage, they should be repaired or replaced.

### **C5.29 Sidewalks**

Periodic inspections should be made of sidewalks, both in unincorporated area, and in cities to ensure that they are safe for users. Breaks, holes, or other damage should be repaired promptly.

Significant variation in height between adjoining slabs in a sidewalk should be corrected. Sidewalk repairs within cities should be handled by city forces where a maintenance agreement exists. Where unsafe conditions are found to exist, cities should be requested to have repairs made promptly.

Curbs that are attached to sidewalks should be maintained approximately to the level of the sidewalks.

### **C5.30 Curb and Sidewalk Repair**

The responsibility for repairing curbs and sidewalks within the right of way will, in general, be assumed by the State.

The exceptions to this are the placement of a sidewalk under encroachment permit, where the permittee will maintain the sidewalk; and where local agencies have requested nonstandard items, in which case, they should be responsible for maintenance costs.

In the event the permittee, upon proper notification, refuses to repair a hazardous sidewalk condition, the duty falls upon the State to repair such condition.

Where a substantial expenditure is required to repair a dangerous or defective condition in a sidewalk, a claim shall be made against the permittee who is obligated to make repairs.

In incorporated cities, the responsibility for maintenance of curbs and sidewalks may be delegated to the city. In such cases, the city should exercise reasonable diligence in the performance.

### **C5.31 Debris Barriers**

Debris barriers such as fencing, walls, cribs, and dikes are installed to reduce the possibility of falling rocks and other material from reaching the traveled way.

Surveillance of debris barriers should be made as needed to ensure functional integrity.

Material accumulated behind debris barriers should be removed before the effectiveness of the barrier is impaired.

### **C5.32 Retaining Walls and Cribs**

Retaining walls may be either plain or reinforced concrete, metal, concrete or timber cribs, or sacked concrete.

Check and repair as necessary all rubble or masonry walls. Concrete or mortar shall conform to Standard Specifications. Keep weep holes in walls open. Prevent erosion at base of walls.

Peel bark from logs, except redwood or cedar, used as cribbing.

Keep timbers free of weeds and fire hazards. Small trees growing between concrete crib members should be removed.

Concrete in sacks stacked one upon another has proven satisfactory for low retaining walls and for paving slopes.

A periodic check should be made on all timber cribs, and bulkheads, for signs of failure. Make such repairs as conditions warrant.

Very large retaining walls may be assigned a bridge number and inspected by Area Bridge Maintenance Engineers. See Section H.05 for details.

### **C5.33 Graffiti Removal**

Offensive or discriminatory graffiti should be removed as soon as possible after discovery.

Removal of other graffiti should be scheduled on a regular basis as are other maintenance activities. In scheduling removal of inoffensive graffiti that is within our right of way and visible, the highway facility should be given top priority over that visible from cross streets, adjacent property, frontage roads, etc.

Maintenance management should be alert for efficient and cost effective ways of handling this problem. Graffiti removal may be scheduled during peak hour traffic when work on the traveled way is not possible. It is also a good activity for the use of those involved in the law violator program. Response to complaints concerning graffiti should be made on a timely basis taking other work priorities into consideration. District and Headquarters personnel making field reviews should be alert for problem areas, and report them as part of their review reports.

Refer to Chapter “D1” of this manual: Litter, Debris and Graffiti.

### **C5.34 Disposal of Waste Material**

In some cases, it may be appropriate to use suitable waste materials to reinforce pavement edges or widen shoulders and parking areas.

To the extent practicable, waste materials shall be hauled to disposal sites that have been approved for that purpose through accepted procedures. In areas where haul distances to disposal sites are unreasonable, earthen waste material may be disposed of along the right of way at locations.

In all cases, these disposal locations must be agreed upon by concerned agencies such as Fish and Game, U.S. Forest Service, Regional Water Quality Control Board, District Stormwater/NPDES Coordinator, and the local enforcement agency responsible for controlling disposal of solid waste. The District Environmental Branch Chief should be consulted for liaison with these agencies. In identifying and using such locations, the prime considerations should be that the material to be disposed of is essentially inert. The following are primary considerations in selecting right of way disposal sites:

- (A) Petroleum-based material such as asphalt pavement shall not be placed in streambeds;
- (B) The sites should not be objectionable from the esthetic standpoint; and
- (C) The waste material shall not go directly into streams or stream channels.

Before using any disposal areas, be certain the water quality control boards are made aware of the locations and concur in their use. The instructions found in Chapter 1 of this manual, Section 1.23: Protection of Sensitive Environmental Resources, apply to disposal of waste material.

When it is not practicable to stockpile or haul material during an emergency, it may be disposed of over the side of the roadbed at the nearest convenient location. Examples of such emergencies are slides that have caused road closures, or when materials on the roadbed are creating traffic hazards.

The disposal location must not create further hazards, or cause problems greater than the existing situation. Only the minimum quantities necessary to open the road and make it safe may be disposed of in this manner.

In the case of large slides (many thousands of cubic yards/ cubic meters), Caltrans may push over the side only the amount of material required to use trucks or hauling equipment to pioneer the slide. Only the minimum quantities necessary to open the road and make it safe may be disposed of in this manner. Remaining material should be stockpiled at a nearby location for temporary storage if necessary, and then later hauled to an approved disposal site, preferably before disposal.

Any emergency disposal of materials into a water body must be reported to the California Department of Fish and Game within fourteen days.

### **C5.35 Non-Motorized Facilities**

Areas where non-motorized travel is permitted, separated bicycle paths, shoulder areas, and sidewalks shall be maintained at a level that provides for safety. Maintenance activities shall include, but not be limited to, sweeping, patching, striping and other functions necessary to achieve the desired level of maintenance. Facilities for non-motorized travel shall be maintained in conjunction with the traveled way.

Non-motorized paths (separated from motor vehicle traveled ways) should be repaired and maintained in the same manner as flexible roadbed. They should be inspected for loose material and swept accordingly.

In addition to using separated bicycle paths, bicyclists are permitted to travel on State highways except certain prohibited sections of freeway. Maintenance procedures and highway improvements on freeways open to bicyclists should ensure safe and convenient bicycling. See Chapter A of this Manual, Section A.22: Non-Motorized Travelers on State Highways for more detailed information.

Section 885-894.2 of the Streets and Highways Code pertains to bicycles.



Figure C5.-3: Half-ton RSP, 2-Sha-5, Postmile 50.1. Courtesy, Kathy Coots, Maintenance Supervisor, 2-98.



Figure C5-4: Half-ton RSP with Weep Pipe, District 10, East Fork Carson River Courtesy, Jim Racin, ESC, Office of State Highway Drainage Design, 1-97.



Figure C5-5: Grouted RSP, District 10, East Fork Carson River. Courtesy, Jim Racin, Office of State Highway Drainage Design, 1-97.



Figure C5-6: Paved Slope Protection Courtesy, Steve Ng, Maintenance and Investigation Office, 4-98.



Figure C5-7: Sacked Concrete Slope Protection, District 2, Trinity County,. Courtesy, Steve Ng, Maintenance and Investigation Office, 4-98.



Figure C5-8: Rock filled double pipe and wire fence, Dry Creek, Lake County. Courtesy, Steve Hg, Maintenance and Investigation Office, 4-98.

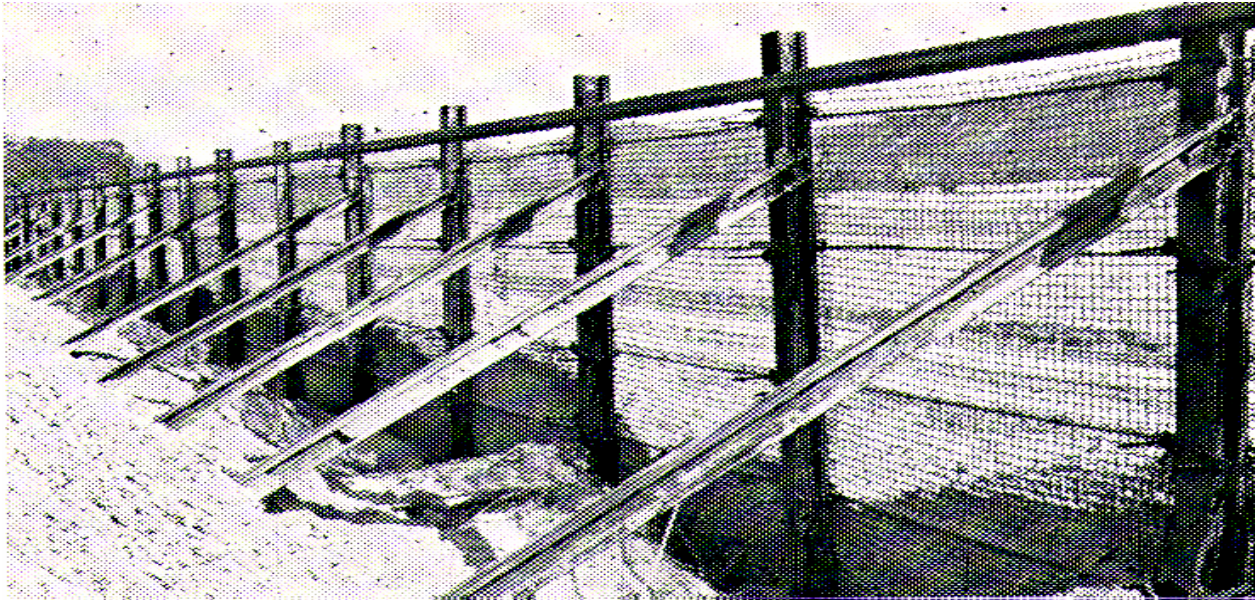


Figure C5-9: Single Row Rail Pile Retard, District 7, Ventura County. Courtesy Steve Ng, Maintenance and Investigations Office, 4-98.

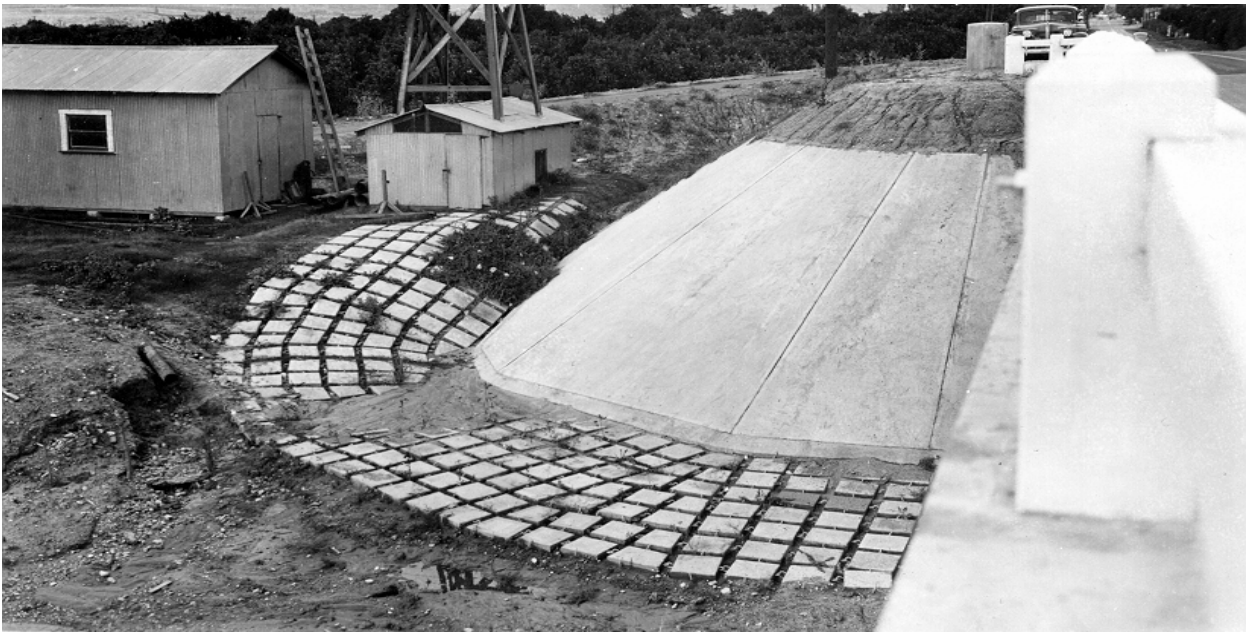


Figure C5-10: PCC Mattress and Concrete Paved Slope Protection Courtesy Steve Ng, Maintenance and Investigations Office, 4-98.

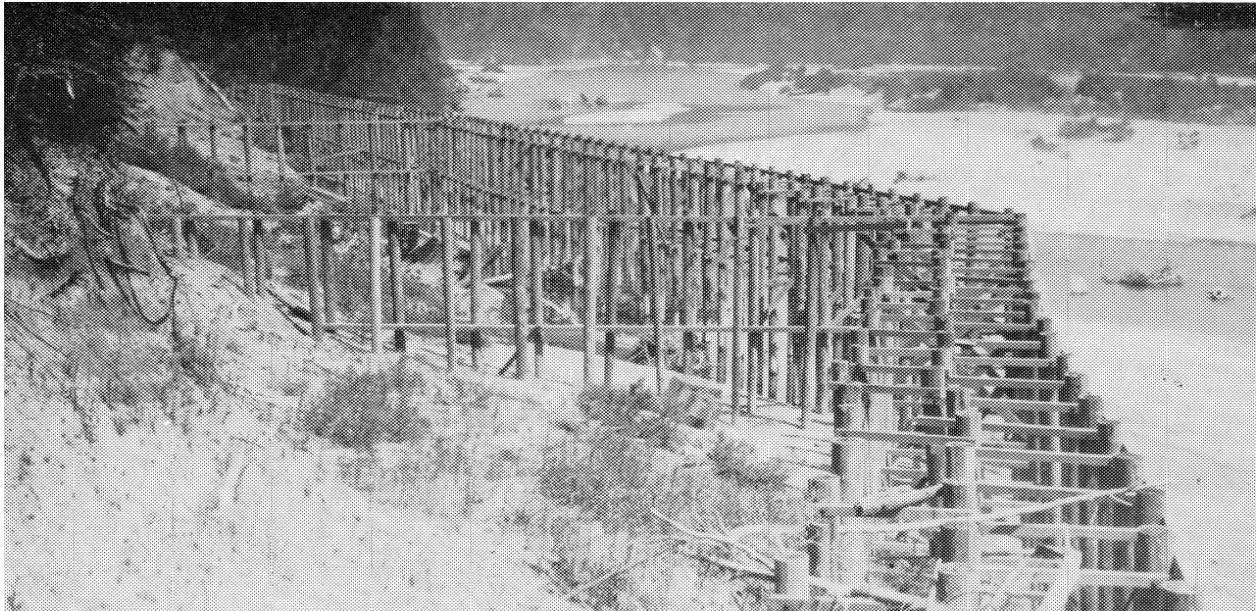


Figure C5-11: Permeable Pile Retard, Humbolt County, Eel River Courtesy, Steve Ng, Maintenance and Investigations Office, Circa 1924.



Figure C5-12: Log Crib Impermeable Jetty, Triangular, Humboldt County, Eel River Courtesy, Steve Ng, Maintenance and Investigations Office, 4-98.

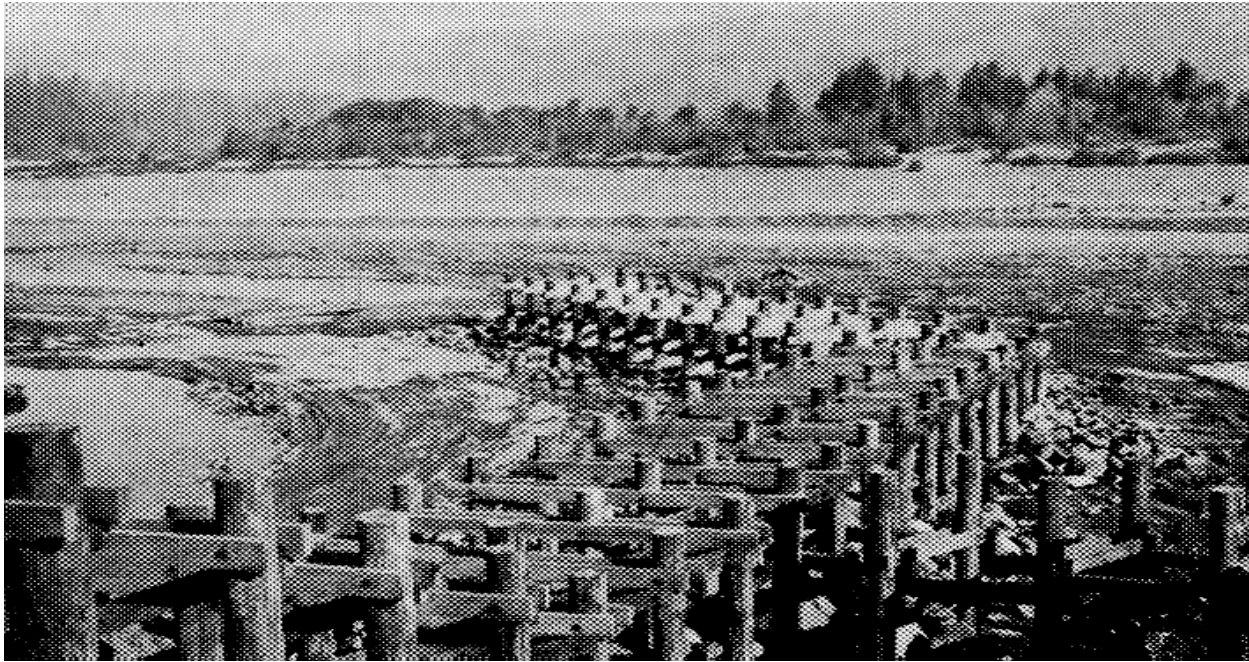


Figure C5-13: Timber Pile Jetty, Permeable, Humboldt County, Eel River. Courtesy, Steve Ng, ESC, Maintenance and Investigations Office, 4-98.



Figure C5-14: Steel Rail Tetrahedon Retard, District 5, Salinas River Courtesy, Steve Ng, Maintenance and Investigations Office, 4-98.



Figure C5-15: Double Row of Fence, rock Filled, District 5, San Benito River Courtesy, Steve Ng, Maintenance and Investigations Office, 4-98.

# CHAPTER D1

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Original signed by  
Sheree Edwards  
Office of Roadside  
Division of Maintenance

## **D1.00 Introduction**

Caltrans removes litter, debris, and sediment to maintain traffic safety (for both motorized and non-motorized travelers), protect water quality, ensure drainage, and provide an attractive facility for travelers and local communities.

Routine litter removal is performed by State forces, Special Programs forces, including supervised inmates and probationers, and Adopt-A-Highway Program participants.

Caltrans removes graffiti to maintain an attractive facility for travelers and local communities.

Refer to Maintenance Manual Volume 2 for planning, scheduling, administrative, and charging practice instructions.

## **D1.01 Policy**

Roadway, roadside, and median litter cleanup operations should be scheduled to provide safe facilities and a neat and clean appearance. Clean up operations also provide water quality benefits by reducing the quantity of materials that may be washed into storm water drainage systems.

Districts shall establish routine litter removal and sweeping frequencies for each route segment based on the rate at which litter, debris, and sediment accumulates. Frequencies shall be determined to keep a generally clean and neat appearance to the roadside and are very sensitive to traffic volumes. These frequencies shall be recorded on district route maps or other formats (post mile listings, etc.). Recorded frequencies shall be used as guides for litter removal, whether by State forces, Special Programs forces, or Adopt-A-Highway participants.

**D1.02 Laws That Pertain to Litter, Debris, Disabled and Abandoned Vehicles**

**(A) Throwing Lighted Substances**

Vehicle Code Section 23111 provides that no one may throw or discharge onto the highway or adjacent area any lighted or unlighted cigarette, cigar, match, or flaming or glowing substance.

**(B) Disposing of Litter or Garbage on Highway**

Vehicle Code Section 23112 provides that no one may throw or deposit on the highway any garbage or substance likely to injure or damage traffic using the highway, or any noisome, nauseous, or offensive matter of any kind. It also prohibits the placement of any rocks, refuse, or dirt within the highway right of way.

**(C) Spilling Loads on Highways**

Vehicle Code 23114 provides that traveling vehicles must be constructed, covered, or loaded to prevent any contents (other than clear water or feathers from live birds) from escaping from the vehicle. This section also prescribes covering loads of vehicles carrying aggregate (including rock fragments), pebbles, sand, dirt, gravel, cobbles, crushed base, asphalt, and similar materials.

**(D) Removal of Material from Highways**

Vehicle Code Section 23113 requires any person who deposits any materials described in Sections 23112 or 23114(d) to immediately remove the material or cause it to be removed. If the person fails to remove the material, the agency responsible for the maintenance of the highway may remove the material and collect the cost of removal and damages from the responsible party. The California Highway Patrol (CHP) may direct a responsible party to remove aggregate material described in Section 23114(d) when that material has escaped from a vehicle.

**(E) Rubbish Vehicles**

Vehicle Code Section 23115 requires that any vehicle loaded with garbage or any other noisome, nauseous or offensive material or anything being transported to a dump may not be driven on the highway unless the load is totally covered to prevent it from spilling on the road. A vehicle in the process of acquiring its load is an exception, unless prevented by local restriction.

(F) Littering Penalties

Vehicle Code Section 42001.7 prescribes fines and mandatory public service for those convicted of violating Sections 23111, 23112 or 23113(a).

(G) Disabled and Abandoned Vehicles

(1) Authority of the California Highway Patrol to Remove Vehicles

Vehicle Code Section 22650 through 22654 describes the authority of the California Highway Patrol or other peace officers, circumstances, and limitations regarding the removal of unattended vehicles.

It is unlawful for Maintenance personnel to remove or authorize the removal of any unattended vehicle from the highway, except as provided in the Vehicle Code.

A vehicle may be removed to a garage only on the authorization of the owner or his agent, or on authorization of a law enforcement officer in whose area of jurisdiction the vehicle is located.

(2) Authority of Local Government (Cities and Counties) to Remove Vehicles

Section 22654(c) of the Vehicle Code further provides that a local authority charged with the maintenance of a highway may move a vehicle that is disabled or abandoned, or which constitutes an obstruction to traffic. Such vehicles may be moved from their location to the nearest available location on the same highway as may be necessary to keep the highway open or safe for public travel.

(3) Authority of Caltrans to Remove Vehicles

Section 22654(c) also provides that Caltrans employees may remove any disabled vehicle that constitutes an obstruction to State freeway traffic from its location to the nearest available location where parking is permitted.

If Caltrans employees move an unoccupied vehicle, they shall comply with the notice requirements of the Code. Caltrans is required to provide immediate notice to the owner of any vehicle that is moved to an area that is not readily visible from its original location. If the owner cannot be notified for any reason, the Caltrans employees who moved the vehicle shall immediately notify the police department of the city in which the vehicle was parked.

If the vehicle had been parked in an unincorporated area of a county, Caltrans shall notify the sheriff's department and nearest office of the California Highway Patrol in that county.

Section 22654(c) of the Vehicle Code gives Caltrans the authority to move vehicles that have been abandoned, disabled, or wrecked upon the highways and the State freeways and which constitute a hazard to traffic. Under this authority, highway forces may move any abandoned, disabled, or wrecked vehicle from the traveled way or shoulder to a safe location in the immediate vicinity. Such vehicles should not be towed any considerable distance. If the flow of traffic is blocked, the vehicle may be removed from the traveled way by any means deemed necessary and prudent by the maintenance person in charge at the site.

(a) Emergency Permits

When a wrecked or disabled commercial vehicle is carrying livestock, flammable, explosive, or perishable cargoes, it is permissible to issue emergency permits to move on weekends or holidays, or after the usual hauling hours. Loaded butane tankers and other highly flammable or explosive cargoes are in the same category.

(b) Caltrans Notification to Responsible Parties

When it is necessary to clear a highway following a wreck, any debris that constitutes a hazard to traffic should be immediately removed from the traveled way by State forces. The district office should immediately ascertain whether the party responsible for the accident wishes to remove any remaining debris from the highway, or whether State forces are to remove it at his or her expense. If possible, commercial tow operators should remove all vehicle parts and debris that constitute a safety hazard.

(c) Removal of Vehicles in Cases of Death or Serious Injury

In accidents where death or serious injury results to any person, the damaged vehicles should be left untouched and traffic protected by flag-persons or barriers, lights, or other means until the California Highway Patrol or other authorized local police officers or sheriffs have had an opportunity to examine the wreck.

In all cases of serious accidents, the Maintenance forces shall cooperate with the California Highway Patrol or local peace officers and the District Attorney's office. State Maintenance forces are not required to await the arrival of insurance company representatives on the scene of an accident before removing wrecked or damaged vehicles.

Department employees shall only assist at the scene of an accident or other disability when commercial tow operators or California Highway Patrol Officers are not available.

(d) Gratuities

Department employees shall not accept gratuities for providing assistance to motorists.

(H) Health and Safety Code Requirement

Section 2952, Health and Safety Code, provides that Caltrans workers who use or transport any pesticide shall promptly notify the local health officer when there is an actual or suspected spill of pesticides.

The notification shall be made by the local Maintenance Area Superintendent, District Landscape Specialist, or Deputy District Director, Maintenance. Employees shall report any observed or suspected pesticide spill or accidental release to their supervisor.

(I) Laws That Pertain to Graffiti

Streets and Highway's Code Section 96 requires the Department to remove graffiti from signs "as soon as reasonably possible."

Public Contracts Code Section 12205 & 12210, Recycled Paint sets percentages for procurement of recycled paints and quality standards.

### **D1.03 Litter**

The accumulation of litter adversely affects the appearance of the highway. Because of the visibility of litter, it is an extremely sensitive issue in the eyes of the public. Careful management of litter removal efforts is essential in maintaining public acceptance of the Maintenance program. All labor resources must be used together to achieve clean roadsides.

Section 91.6 was added to the Streets and Highways Code in 2003, and reads in part “The Department shall, within its Maintenance programs relating to litter cleanup and abatement, assign a high priority to litter deposited along State highway segments adjoining storm drains, streams, riverways, beaches, the ocean, and other environmentally sensitive areas.”

In addition, removal efforts should be focused on routes to airports, commuter routes, and heavily traveled inter-city routes. It is important to give special attention to litter removal on scenic highways, coastal and parkland routes, at vista points, and other areas frequented by tourists and recreational motorists.

#### **(A) Manual Removal of Litter**

In areas with heavy or fast traffic where litter is removed manually, only highly visible litter and those items that will not biodegrade should be removed. This will reduce worker exposure time.

#### **(B) “No Dumping” Signs**

Maintenance Supervisors should observe overall conditions and assess the need for litter removal and installation of “No Dumping” signs. “No Dumping” signs should be installed when dumping becomes a problem on the highway, at Park and Ride lots, rest areas, and vista points.

#### **(C) Litter Bags**

Litter bags should be carried in maintenance vehicles for use as needed.

#### **(D) Exposure of Litter Due to Fires or Maintenance Operations**

Litter should be picked up promptly when it is exposed by roadside fires, mowing or pruning of shrubs.

**(E) Litter Receptacles**

Litter receptacles shall not be placed on freeways.

Receptacles may be placed at designated vista points or Park and Ride lots, only if specifically approved by the Maintenance Region Manager, and where adequate space is available and provision has been made for safe entry and exit. Such receptacles are not normally provided as part of these facilities. The District Landscape Architect or the Division of Structures, Transportation Architecture Branch, should be contacted for specific location and receptacle type.

On other highways, litter receptacles may be placed only in areas where approved by the Maintenance Region Manager. Such receptacles are not intended for commercial or household garbage and debris, and should be removed if this becomes a problem.

Litter receptacles should be emptied at least once a week, or more often as necessary. Additional temporary litter receptacles may be provided over three-day weekends when heavy use is expected. The site surrounding receptacles locations shall be kept clean and free of litter and weeds to eliminate fire hazards during the dry season.

**D1.04 Debris and Sediment**

**(A) Sweeping of Sediment**

Debris and sediment that accumulates on paved surfaces should be swept regularly to provide a safe and clean facility.

All highway and shoulder sweeping, with the exception of rest areas, vista points, and Park and Ride lots, should be charged to the "F" Family. (See Maintenance Manual Vol. 2, Activity F20051).

Depending on traffic, weather, and available resources, sweeping frequency should usually be based upon collecting a minimum of ½ cubic yard and a maximum of one (1) cubic yard of material per mile swept. The portion of the roadway used by non-motorized travelers, e.g., bicycle lanes and separate paths, may require more frequent sweeping. Sweeping schedules should be consistent with the Caltrans Statewide Storm Water Management Plan, Best Management Practice - Highway and Freeway Cleaning (MD-10).

Sweepings should be disposed of in accordance with federal, State and local disposal requirements for solid waste.

**(B) Removal of Debris from the Roadway**

Debris on the roadway should be removed immediately when it constitutes a traffic hazard. Such debris may include tire casings, large boxes, bags of garbage, dead animals, automobile wreckage, spilled loads, and other items.

Large accumulations of debris, paper, cartons, and tumbleweeds that obstruct sight distances should be removed from freeway fences. Cattle guards should be inspected periodically, and debris should be removed when necessary.

Cities, counties, and adjacent property owners should be informed of their responsibilities when litter accumulates outside the right of way between the freeway fence and local roads or fences.

**D1.05 Signs and Posters**

Illegal signs or posters placed within the right of way, such as those advertising garage sales, fruit stands, political candidates, new homes, etc., should be promptly removed. Signs should be stored in the Maintenance station for 30 days for retrieval by the sign owners. Contact the Outdoor Advertising unit of the Traffic Operations Division for further information regarding sign removal procedures.

**D1.06 Graffiti**

Caltrans responds to the statewide graffiti problem by removing the marks quickly, and as often as necessary to discourage the offenders. Refer to Caltrans Deputy Directive DD-39 for the complete graffiti removal and prevention policy.

Routine graffiti removal is performed by State forces, Special Programs People and Adopt-A-Highway participants. Graffiti is also removed through contracts with the California Conservation Corps (CCC), local agencies, and private contractors.

Graffiti should be removed immediately from traffic devices if they are a safety concern. All graffiti of obscene nature should also be removed immediately. Other graffiti should be removed within ten (10) working days upon notification. Graffiti painters, or “taggers”, are discouraged by frequent removal of their marks, so it is important to remove graffiti as soon as possible in all cases.

**(A) Recycled Paint**

Consistent with the intent of the Legislature, Caltrans should order and use recycled paints for sound walls, retaining walls, bridge girders, and abutments. Make reasonable efforts to match colors. The statewide Department of General Services contract is available for procurement of recycled paints.

**(B) Protective Devices**

Some physical devices which are available to limit access by taggers to State property are rat guards, sign hoods, razor wire, and glare screen patches.

In areas where significant numbers of ground mounted highway signs are being defaced, districts should consider ordering replacement signs with an approved protective coating applied by the manufacturer, or apply their own approved protective sheeting to existing signs.

**(C) New Product Evaluation (NPE) Procedures and Approved List**

There are many products available to aid in the control of graffiti, both for prevention and removal. New products are constantly being developed.

Caltrans maintains a list of products that have been tested for safety and effectiveness.

Only products that are on this approved list are to be used on highway features.

Manufacturers should be directed to submit new products to the New Products Coordinator within the Engineering Service Center.

Refer to Caltrans Deputy Directive DD-45 for new product evaluation procedures.

**(D) Multi-Agency Graffiti Intervention Committees (MAGIC)**

Multi-Agency Graffiti Intervention Committees (MAGIC) are regional anti-graffiti organizations. They are effective in coordination of regional resources and efforts from local agencies. Districts with significant graffiti problems should be actively involved in MAGIC organizations.

### **D1.07 Spills of Hazardous Materials on Highways**

See Chapter “D-5”, "Spills of Substances on Highway Rights of Way" of this manual for information on the handling of hazardous spills.

### **D1.08 Disposal of Animal Carcasses**

Each Area Superintendent should establish a procedure for the removal of dead animals from the State right of way. In some areas, there are local animal control agencies that handle injured, dying, or dead animals. If such a service is available, make arrangements to utilize their services through an agreement or service contract. When such services are not available, the Superintendent should select the most reasonable form of disposal, including authorized dumps or burial, considering local rules and regulations.

Where possible, owners of domestic animals should be notified before disposal. License tags, nameplates, or other identification should be retained in the supervisor's office for at least 30 days in case of subsequent inquiries.

### **D1.09 Special Programs People (SPP)**

Special Programs People (SPP) assist Caltrans through inter-agency or cooperative agreements with other State or county agencies.

Typical tasks for SPP are litter removal, weed abatement, pruning, clearing fence lines, drainage facilities, and other labor-intensive activities on State right of way. Special Programs People provide services above those provided by Caltrans forces.

Special Programs People most frequently include the following:

- Probationers/Court referrals (PROBAT)
- Inmate work forces (INMATE)
- Work furlough (WKFURL) or Work release (WKRELS)
- California Conservation Corp (CCC)

Special Programs People's responsibilities for supervision, safety orientation, and other details, are discussed in the interagency agreement or cooperative agreement. Prior to start of work, all SPP shall be given a safety orientation that includes review of the applicable Codes of Safe Operating Practices and Best Management Practices.

Each district has conducted a safety review of its highway system to identify locations with high traffic volumes, narrow roadsides, and other factors that indicate the need for additional protections for workers on foot. Such areas are deemed to require protective measures above the minimum mandated in Chapter 8 of the Maintenance Manual. The contents of the district plan should be known before Special Programs People are deployed on highway roadsides.

### **D1.10 Adopt-A-Highway Program**

A substantial amount of roadside litter is collected by individuals, organizations, and businesses under the Adopt-A-Highway Program. Adopt-A-Highway participants also plant trees and wildflowers, remove graffiti, provide vegetation control, and perform other activities.

Authorization for this program is Streets and Highways Code Section 91.5, and the Director's Policy Memo on Adopt-A-Highway, dated January 15, 1995. Adopt-A-Highway Program guidelines implement legislation (S & H Code Sec. 222) for the acceptance of funds, materials, equipment, or services for roadside maintenance or enhancement.

In addition, this legislation allows the Department to recognize participants via Adopt-A-Highway courtesy signs. There is no fee charged for the manufacture or installation of courtesy signs.

Detailed instructions for administering the Adopt-A-Highway Program are described in the *Adopt-A-Highway Program Guidelines* issued by the Maintenance Division. The Caltrans publication "Adopt-A-Highway Information and Application" summarizes the procedures and requirements of the program for the general public.

#### **D1.10.1 Adopt-A-Highway Program Litter Procedures**

Adopt-A-Highway participants are a proven resource for litter reduction. Participants agree to collect litter from a two-mile segment of roadside for five (5) years. The adopted segment may include one or both sides of the highway.

Districts should continue to routinely remove litter and debris from the median, roadway, shoulders, and other areas of adopted segments that are inaccessible to adopters.

Litter removal may need to be augmented by State forces or Special Programs People if the groups established pick-up frequency is not adequate to keep an area clean.

##### **(A) Designating New Litter Removal Adoption Sites**

District Maintenance personnel review and designate new highway sections for litter removal adoption. Depending on site conditions, segments may be classified as adoptable or not adoptable.

Areas that would require lane or shoulder closures for litter removal are unsuitable for adoption.

The exact length of highway adoption and number of cleanups per year may vary according to the project location; however, a minimum of six (6) cleanups each year is required.

(B) Site Reviews

As coordinated through the District Adopt-A-Highway Coordinator, site reviews must be performed when designating new adoption sites, every five (5) years upon permit renewal, and after construction.

(C) Cleanup Frequency

Districts should set a cleanup frequency that is adequate to keep the roadside clean yet not so high as to discourage participation in the program. Cleanup frequencies should be reviewed and, if needed, revised after each five (5)-year permit period. Highway segments that require more than twelve pickups per year generally are not suitable for volunteers, but may be adopted by groups who are willing to hire a contractor to perform the work on their behalf.

(D) Safety Orientation

Districts shall provide a safety orientation to volunteer group leaders and contractor crew leaders for each adopted/sponsored site prior to their beginning adoption activities.

The orientation must take place within 30 days of the adopter's encroachment permit start date, regardless of whether or not the adopter's recognition panel has been installed. Items to be covered during the orientation are detailed on the *Adopt-A-Highway Safety Orientation Checklist*. The *Checklist* is available from District Adopt-A-Highway Coordinators.

(E) Litter Bags and Safety Equipment

Participants should be given white litter bags with the Adopt-A-Highway logo for use when collecting litter. This special litter bag is available from the warehouse. (State forces and Special Programs People should use the standard, orange plastic litter bag). Participants should be directed to obtain litter bags at a designated location. Typically, the designated location is the local Maintenance station. However, districts are encouraged to make special arrangements to provide appropriate quantities of bags to remotely located *volunteer* participants. Adopt-A-Highway contractors may be provided with a 60-day supply of litter bags.

*Volunteer* litter removal groups shall also be issued safety gear (hard-hats, vests, gloves, protective eyewear, and litter pickers). Adopt-A-Highway contractors should not be issued safety equipment.

Litter bags and safety equipment shall be replenished as needed throughout the permit period.

**(F) Collection of Filled Litter Bags**

Adopt-A-Highway participants should be instructed to leave filled litter bags at the outside edge of the shoulder for pickup by district Maintenance forces. Adopters should also be instructed to cluster bags together whenever possible.

Districts should pick up filled bags promptly. Bags should not be allowed to remain on the roadside for more than five (5) days.

**(G) Coordination of Maintenance Activities**

Adopt-A-Highway groups are instructed to give their Maintenance representative a minimum of five (5) days notice prior to each work event. The district should coordinate its median and roadway litter removal as closely as practical with the adopter's schedule.

Mowing operations performed just before a litter pickup cause problems for Adopt-A-Highway participants by shredding litter into small pieces. Therefore, as a courtesy to adopters, supervisors should consider notifying Adopt-A-Highway groups working in their area of responsibility of scheduled mowing dates.

**(H) Monitoring Groups**

Districts should monitor the adopter's level of performance and communicate promptly with the adopter if there is a deficiency. Violations of the group's permit provisions should be reported to the District Adopt-A-Highway Coordinator so that a formal warning letter may be sent to the group. The group's permit will be revoked upon the third violation. Action must be taken to immediately revoke a permit if a permittee demonstrates a deliberate disregard for safety.

(I) Tracking of Adopt-A-Highway Expenditures

District Maintenance forces should report the quantities of Adopt-A-Highway litter bags collected into IMMS using IMMS Activity D40101, with Asset FAC. Detailed instructions for *Recording Adopt-A-Highway Bag Counts* are available on the intranet at [http://onramp.dot.ca.gov/hq/maint/adopt/imms\\_procedures1.htm](http://onramp.dot.ca.gov/hq/maint/adopt/imms_procedures1.htm).

IMMS activities are also available for recording time spent performing Adopt-A-Highway safety orientations, sign installation and removal, and general Adopt-A-Highway-related tasks. See Maintenance Manual Volume 2 for complete charging practice instructions.

**D1.10.2 Adopt-A-Highway Graffiti Operations**

Adopt-A-Highway volunteers can be an effective resource for painting over graffiti. Participants agree to adopt a wall or other structure(s) for five (5) years. The highway side, the community side, or both sides of a wall may be included in the adoption. More than one structure can be included in the adoption.

Districts should not perform routine graffiti removal on structures that are the adopter's responsibility, unless it is offensive and needs immediate attention.

(A) Designating New Graffiti Removal Adoption Sites

District Maintenance personnel review and designate new structures for graffiti removal adoption. Depending on site conditions, structures may be classified as adoptable or not adoptable.

Areas that would require lane or shoulder closures for safe graffiti removal are unsuitable for adoption, with the exception of the maintenance of murals that are adopted under the Adopt-A-Mural component of the Graffiti Removal element of the Adopt-A-Highway Program. Signs may not be adopted. In addition, districts should not allow adoption of structures in areas where there is a graffiti abatement policy in effect of less than 72 hours.

(B) Site Reviews

Upon request by the District Adopt-A-Highway Coordinator, site reviews must be performed when designating new adoption sites, every five (5) years upon permit renewal, and after construction.

(C) Frequency

Districts should determine the turnaround time for graffiti removal. Turnaround time should be reviewed and, if needed, revised after each five (5) year permit period.

(D) Safety Orientation

Districts shall provide a safety orientation to volunteer group leaders and contractor crew leaders for each adopted/sponsored site prior to their beginning adoption activities.

The orientation must take place within 30 days of the adopter's encroachment permit start date, regardless of whether or not the adopter's recognition panel has been installed. Items to be covered during the orientation are detailed on the *Adopt-A-Highway Safety Orientation Checklist*. The *Checklist* is available from District Adopt-A-Highway Coordinators.

(E) Materials and Safety Equipment

Districts may provide paint to graffiti removal participants or allow participants to purchase their own. Caltrans personnel must tell the adopter which type and color of paint to use. A list of State-approved paints is available from the Maintenance Division.

*Volunteer* graffiti removal groups shall also be issued safety gear (hard-hats, vests, gloves, and protective eye wear). Adopt-A-Highway contractors should not be issued safety equipment. Graffiti removal groups whose adoptions include litter removal around the adopted structures shall also be issued litter bags and litter pickers. Materials and safety equipment shall be replenished as needed throughout the permit period.

(F) Monitoring Groups

Districts should monitor the adopter's level of performance and communicate promptly with the adopter if there is a deficiency. Violations of the group's permit provisions should be reported to the District Adopt-A-Highway Coordinator so that a formal warning letter may be sent to the group. The group's permit will be revoked upon the third violation. Action must be taken to immediately revoke a permit if a permittee demonstrates a deliberate disregard for safety.

(G) Tracking of Adopt-A-Highway Expenditures

Appropriate IMMS Activity codes should be used for recording time spent performing Adopt-A-Highway safety orientations, sign installation and removal, and other Adopt-A-Highway-related tasks.

D1.10.3 Adopt-A-Highway Program - Roles and Responsibilities

(A) Role of the District Adopt-A-Highway Coordinator

The Adopt-A-Highway Program responds to a large number of contacts by the public, legislators, local officials, the media, and Caltrans management. It is essential that districts provide timely, professional, and courteous responses to inquiries regarding the program.

Each district must assign a full-time District Adopt-A-Highway Coordinator.

The Coordinator depends on the cooperative assistance of the entire Maintenance function and on other essential units within the district. Many of the District Coordinator's logistical responsibilities may be effectively delegated.

The District Coordinator's responsibilities include the following:

- (1) Conducts ongoing community outreach to promote and explain the Adopt-A-Highway Program:
  - Coordinates with Public Affairs to promote the program and responds to inquiries from public officials and the media.
  - Maintains and makes available for public view a list of:
    - (a) Available adoption sites
    - (b) Program participants
    - (c) Waiting lists for sections that are currently adopted

(2) Processes Adopt-A-Highway permit applications:

- Assists potential participants in understanding the program, defining projects, and securing technical advice from the District Landscape Architect, Landscape Specialist, or other Caltrans professionals.
- Ensures that applicants meet the criteria set in Adopt-A-Highway Program policy for participation in the program (i.e. participants may not advocate violence or discrimination according to the law, etc.).
- Submits permit applications and required support documentation to the District Permit Engineer for processing.
- Ensures that the Adopt-A-Highway encroachment permit has been issued.
- Reviews and approves recognition panel content.
- Places work orders for courtesy signs and recognition panels.
- Ensures that the courtesy signs and recognition panels have been installed in a timely manner.
- Issues permit renewal notices.

(3) Maintains district program data:

- Keeps a database of program participants and adoption sites.
- Forwards a monthly summary of program participation and bag counts to the statewide Adopt-A-Highway Coordinator.

(4) Communicates periodically with active participants:

- Distributes safety bulletins, statewide cleanup event invitations, and special service awards to volunteers.
- Issues formal warning letters when the adopter's level of performance is deficient.
- Requests that the District Permits Engineer revoke encroachment permits for repeated violations.
- Notifies permittees to suspend activities within areas undergoing construction.

- (5) Maintains a close working relationship with Headquarters and district personnel, and others who are essential to the successful administration of the program:
- Attends periodic statewide Adopt-A-Highway Coordinator's meetings.
  - Participate in task forces or other special committees.
  - Consults with appropriate Maintenance personnel to review and designate new highway sections for adoption.
  - Consults with Maintenance Supervisors for periodic site reviews.
  - Consults with Maintenance Supervisors regarding performance of adopters.
  - Provides Maintenance Supervisors with current lists of adopters in their area of responsibility.

**(B) Role of the Maintenance Region Manager**

- (1) Ensures that Area Superintendents, Maintenance Supervisors, and other region staff who work directly with Adopt-A-Highway participants understand the program's objectives and procedures and follow roles and responsibilities as outlined in this section.
- (2) Ensures that special reporting requirements are being followed for recording Adopt-A-Highway bag counts into the IMMS.

**(C) Role of Maintenance Area Superintendent**

- (1) Verifies that supervisors accurately report bag counts and hours worked performing Adopt-A-Highway activities into the IMMS database, complete site reviews in a timely manner, and report on performance of the adopters.
- (2) Ensures that employee interaction with the public is professional, positive, prompt, and courteous.
- (3) Ensures friendly and convenient procedures for participants to receive a safety orientation, receive safety gear and supplies, and to provide advance notice of work dates.
- (4) Ensure that Adopt-A-Highway courtesy signs are provided, installed, and maintained in a timely manner. The signs alert the motorist and the California Highway Patrol that volunteers may be present on the roadside.
- (5) Ensures that Maintenance Supervisors understand the program's objectives and procedures and follow roles and responsibilities as outlined in this section.

(D) Role of Maintenance Supervisors and Maintenance Personnel

District Maintenance crews are the primary contact between Caltrans and Adopt-A-Highway participants during the five (5)-year permit period. Maintenance Supervisors (or their designees):

- (1) Perform site reviews upon request by the District Adopt-A-Highway Coordinator when designating new adoption sites, upon permit renewal, and after construction.
- (2) Provide a safety orientation to volunteer group leaders and contractor crew leaders for each adopted/sponsored site prior to their beginning adoption activities.
- (3) Provide information specific to each adopted site to Adopt-A-Highway contractor's crew leader.
- (4) Issue and replenish participant's supply of safety equipment and materials throughout the five-year permit period.
- (5) Recover participant's safety equipment (including litter pickers, when applicable) and unused materials if the participant does not renew their encroachment permit.
- (6) Provide friendly and convenient procedures for participants to provide advance notice of work.
- (7) Courtesy signs, including recognition panels, should be provided, installed, and maintained for each project. The signs recognize the participant and let the public know that the section is being maintained by other than State forces. Courtesy signs also alert the motorist and the California Highway Patrol that volunteers may be present on the roadside.
- (8) Ensure that Caltrans pesticide spray activities do not impact participants' ability to work.
- (9) Coordinate median and roadway litter removal as closely as practical with the adopter's schedule.
- (10) Coordinate removal of litter bags within five (5) days of collection.
- (11) Record bag counts and hours worked performing Adopt-A-Highway activities into the IMMS database.

- (12) Monitor performance of participants. Document performance deficiencies and inform the District Adopt-A-Highway Coordinator when the performance of a group should be improved or the group's permit should be revoked.
- (13) Ensure that participant's activities are suspended within areas that are undergoing construction until the State has accepted responsibility for the construction area from the contractor.
- (14) Store Adopt-A-Highway sign components during construction periods.
- (15) Notify the District Adopt-A-Highway Coordinator when the construction is complete.

# **CHAPTER D5**

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*Original signed by*  
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Division of Maintenance

## **D5.00 Introduction**

By statute (Streets & Highway Code, Art. 27 [c]), the California Department of Transportation (Caltrans) has the responsibility of maintaining a safe and usable highway system. Caltrans actions will be based upon the information available at the time of the emergency. After proper identification and hazard assessment, Caltrans will take action to contain spilled material, to remove it or to have it removed by the spiller or by a qualified contractor, and to ensure it is disposed of properly.

Districts shall provide an emergency response for all highway spills to effect the following levels of service:

- (A) Caltrans emergency responders shall be enroute within 30 minutes after notification.
- (B) District shall conduct hazard assessment as soon as possible and will begin cleanup operations when not prohibited by health or safety considerations for employees or the public.
- (C) Notify District Maintenance Hazardous Materials Managers (Hazmat Managers) during the initial notification process.

## **D5.01 Definition of “Hazardous Material”**

Hazardous materials are defined in California Code of Regulations (CCR) Title 22 and the Code of Federal Regulations (CFR) Title 49. A hazardous material is one that poses an unreasonable risk to the health and safety of employees, the public, or the environment if it is not properly controlled during handling, storage, manufacture, processing, packaging, use, disposal, or transportation. They may be gases, liquids, solids, or combinations of these physical states.

The United Nations system provides nine hazard classes:

- Class 1 - Explosives
- Class 2 - Gases
- Class 3 - Flammable liquids (and Combustible liquids)
- Class 4 - Flammable solids; Spontaneously combustible materials; and  
Dangerous when wet materials
- Class 5 - Oxidizers and Organic peroxides
- Class 6 - Toxic materials and Infectious substances
- Class 7 - Radioactive materials
- Class 8 - Corrosive materials
- Class 9 - Miscellaneous dangerous substances

When a hazardous material is spilled on the State highway system, it must be cleaned up according to the appropriate regulatory agency requirements. See D5.04 (D): Agency Jurisdictions.

### **D5.02 Caltrans Use of the Standardized Emergency Management System**

As a department of State government, Caltrans is required by Section 8607 of the California Government Code to use the Standardized Emergency Management System (SEMS) in any multi-agency emergency response.

Many highway spills involve multiple agencies, as described in this chapter. Caltrans Maintenance shall train all field employees in SEMS and use the SEMS structure at all highway spill emergencies with multi-agency response.

See D5.08(A): Training in the Standardized Emergency Management System (SEMS).

See the Caltrans Training Catalog, Mandated Training: SEMS Introductory Course; SEMS Field Course; and SEMS EOC Course.

### **D5.03 Caltrans Responsibilities in Hazardous Spills Emergencies**

In managing emergency spill conditions, Caltrans will establish traffic control to provide public safety. Caltrans will perform hazard assessment to establish reasonable precautions to prevent Caltrans employees, the public, and the environment from being exposed to hazardous or unidentified substances.

If at any stage of this process it appears that Caltrans employees cannot proceed safely using standard Departmental procedures and equipment, Caltrans will use the services of a pre-qualified cleanup contractor.

Within the State highway right of way, Caltrans will take the following actions:

- (A) Ensure that the dispatch center specified in the District Spill Contingency Plan immediately notifies the Hazmat Manager in the event of any hazardous material incident affecting a State highway.
- (B) Make notifications and reports as required by law and Departmental procedures, at the request of the first responder.

- (C) Assign a Caltrans representative to cooperate with other public and private agencies to ensure:
  - (1) Isolation and containment of spilled material.
  - (2) Identification and hazard assessment of the material
  - (3) Proper removal and disposal of hazardous materials.
  - (4) Restoration of the orderly flow of traffic.
- (D) Assist the California Highway Patrol (CHP) or other jurisdictional law enforcement agencies in developing and implementing traffic control and routing operations.
- (E) Oversee the restoration of contaminated highways and other transportation facilities under Caltrans jurisdiction.

Unless Caltrans is the spiller, Caltrans is not legally or financially responsible for contamination or cleanup outside the State right of way, even though the incident begins within the right of way. The Incident Commander (IC) shall be notified of contamination outside of the State right of way.

The Hazmat Manager is the contact person for detailed information regarding handling and cleanup of hazardous materials spills.

#### **D5.04 Organizational Authority**

- (A) Delegation of Responsibility and Authority: California Vehicle Code, Section 2454

It is the responsibility of Caltrans and the appropriate law enforcement agencies to take action when spills of unidentified or hazardous substances occur on State highways. Section 2454 of the Vehicle Code provides that authority for incident command at any on-highway hazardous substance spill or disaster shall be passed to the law enforcement agency having primary traffic investigative authority.

CHP is the authority on all freeways and on most State routes. CHP may also be responsible for some county roads through agreement with local law enforcement agencies. Local law enforcement is responsible for surface roads and streets and for State routes through cities, as delegated by joint agreement with CHP.

**(B) Responding Agencies**

There may be several emergency response agencies at the site, such as local law enforcement, fire department, county environmental health, Caltrans, and other State agencies. Each agency, including Caltrans, will designate a representative on site to work with the IC.

**(C) Incident Command**

The CHP is the Incident Commander on all freeways and on most State routes. All emergency responders and their communications shall be coordinated and controlled by the IC.

The IC's function is to coordinate communications and the activities of emergency response agencies through working directly with agency representatives.

The IC is not involved in direction of specialized functions provided by other agencies.

**(D) Agency Jurisdictions**

Jurisdictions of local, State, and federal environmental agencies must be taken into consideration during a hazardous materials incident and during cleanup operations.

Caltrans representatives shall confer with these and other agencies as required to assure there has been proper cleanup of the spill. These jurisdictions include, but are not limited to, the following:

- (1) The County Health Officer or designated local agency is the authority on soil contamination resulting from spills throughout the county. Some cities have local ordinances on soil contamination. The county is usually the Certified Unified Program Agency (CUPA) designated by the California Environmental Protection Agency (Cal/EPA) to enforce State environmental laws.
- (2) The County Agricultural Commissioner has jurisdiction when pesticides or other potentially hazardous agricultural materials are involved in an incident.
- (3) The Air Pollution Control District representative has control over amounts of contaminants allowed in the air.
- (4) The Regional Water Quality Control Board representative is the authority on contamination standards in the adjacent stream or underlying water table.

- (5) State Department of Fish and Game officers have control over what is allowed to enter the roadside streams, rivers, and lakes.
- (6) Cal/EPA is the State's environmental agency, which includes the Department of Toxic Substances Control (DTSC). Cal/EPA usually delegates its enforcement authority to the counties.
- (7) The Governor's Office of Emergency Services (OES) provides coordination during large incidents and other disasters. Many counties have their own emergency operations centers that coordinate communications and resources on the county level.
- (8) The Federal Environmental Protection Agency (EPA) may respond to large incidents.
- (9) The Coast Guard has jurisdiction over all navigable waters.

Refer to the District Hazardous Materials Contingency Plan for detailed information regarding local administering agencies and jurisdictions.

**(E) Resolution of Disputes During Spill Response.**

The Department of Transportation -- California Highway Patrol Joint Operational Policy Statement provides: "... Reopening of the highway will be with the concurrence of both departments. Difference of opinion concerning closure or reopening will be resolved in favor of maximum protection for the public and Caltrans employees."

If there is disagreement between Caltrans and other responding agency representatives concerning matters such as cleanup methods or when to open the roads, differences of opinion will be resolved as described in the above policy.

### **D5.05 Emergency Authority of the Incident Commander**

During declared emergencies, the IC may waive specific Hazardous Waste Control laws to allow Caltrans or its contractors to haul any amount of spilled regulated wastes off the highway to eliminate traffic gridlock and restore public safety.

Under direction of the IC, Caltrans may place containers that are undamaged back on the spiller's vehicle when this can be accomplished safely. The containers may be overpacked and hauled away by the spiller if qualified persons are available to handle damaged containers. This permits a spiller or responsible party to haul away regulated materials to its own facilities.

Even during an emergency, the spiller must be qualified and licensed to handle and transport the materials. Hazardous wastes cannot be transported without a Hazardous Waste Hauler's Registration. See D5.06(D).

Caltrans workers shall never work beyond their level of training or capabilities as described in this chapter during hazardous materials emergencies. Employees shall never take action that is prohibited by this chapter, by Codes of Safe Operating Practices, or by Departmental policy. See D5.08(B): Hazardous Materials Training.

### **D5.06 Responsible Parties, Identification of Materials, and Cleanup of Spills**

The responsible party (the spiller) shall bear all costs incurred in removal and disposal of all spilled materials, whether they are hazardous or not.

- (A) The principal tasks in handling a spill are usually performed in the following order:
- (1) Safe approach;
  - (2) Isolation and containment;
  - (3) Notifications;
  - (4) Identification and hazard assessment; and
  - (5) Cleanup and disposal.

- (B) Depending upon conditions, identification and hazard assessment, containment, and cleanup may be performed by one or more of the following qualified operators under the direction of a Caltrans representative, trained as a minimum at the First Responder Operational (FRO) level:
  - (1) The spiller of the material or the spiller's agent, if qualified.
  - (2) Caltrans
  - (3) A qualified hazardous materials cleanup contractor who is under contract with Caltrans to identify unknown materials, or is qualified and called to the scene by Caltrans.
  - (4) Local environmental response agencies
- (C) The decision as to who will clean up the spill depends upon:
  - (1) Whether the material is known to be hazardous or non-hazardous (hazard assessment).
  - (2) The willingness and ability of the spiller to participate.
  - (3) Timeliness of response.
  - (4) Required equipment, expertise, and resources for cleanup.
- (D) The spiller or its agents may be permitted by Caltrans to perform one or more of the tasks if the Caltrans representative or Unified Command determines the spiller or agent is qualified to undertake the work. Qualification is based on:
  - (1) Ability to respond in a timely manner.
  - (2) Ability to ensure the safety of employees, the public, the environment and property.
  - (3) Other considerations that affect an efficient and appropriate clean-up operation.
  - (4) In all cases, approval to haul hazardous spilled material will be granted only to companies possessing a current Hazardous Waste Hauler's Registration, and which meet all local and State requirements including training of cleanup workers.

- (E) If the spiller or responsible party does not clean up the spill adequately, Caltrans may call another qualified cleanup contractor to finish the cleanup at the expense of the spiller or responsible party. Caltrans, County Environmental Health, or County Health may determine if the spiller has not done an adequate job in its cleanup.
- (F) The Caltrans representative will choose a qualified cleanup contractor for an incident under the following circumstances:
  - (1) The spiller or responsible party elects not to arrange for cleanup.
  - (2) The material is not identifiable except by chemical analysis, which the spiller is unable to provide.
  - (3) The spill appears to be too hazardous for Caltrans to handle within normal operational limits.
  - (4) The spill requires specialized equipment or expertise beyond the capabilities of the spiller or Caltrans.
- (G) Non-emergency and non-hazardous spill removals that require one or more return trips to the site by the spiller will require that the spiller, or the spiller's agent, obtain a salvage permit from the Maintenance Region Manager for such activity.

Encroachment permits are required for cleanup or remediation operations. See Section 501.24 and Appendix D of the Caltrans Encroachment Permit Manual for details.

In addition, a transportation permit issued by Caltrans, Transportation Permits staff may be required for over-length or over-weight tows.

**D5.07 Cleanup and Transport Requirements for Government Agencies**

Exclusive of that described in D5.03 above, the California Code of Regulations (CCR) Title 22, Regulatory Exemption, Article 66263.43, allows emergency responders from a State, local, or county governmental agency to take the following actions:

- (A) After the hazardous material has been identified, government agencies may clean up and haul a limit of five 85-gallon overpack drums per vehicle to a holding site on the agency's property without using container labels or hazardous placard. An appropriate site safety plan must be used. Shipping papers containing all DOT-required information must accompany the hazardous waste when it is transported under this exemption.

Stored waste should be disposed of as soon as practical and under no circumstances stored longer than 90 days.

- (B) The appropriate manifest is required when hauling hazardous wastes or non-hazardous waste off-site to a recycler or registered landfill. Transport of hazardous wastes shall be performed only by a registered hazardous waste hauler.
- (C) The governmental agency using this exemption shall keep all records of the types and quantities of hazardous wastes handled under this section at the central collection facility on an annual basis. These records shall be retained for a minimum of three (3) years from the date the record was completed.

**D5.08 Training**

- (A) Standardized Emergency Management System (SEMS)
  - (1) Training in the SEMS is required for all Maintenance personnel who may respond to a highway spill emergency.
  - (2) All field Maintenance personnel through the rank of Supervisor shall attend the SEMS Introductory Course (G 21430). Caltrans instructors teach this course.
  - (3) Maintenance Area Superintendents, Maintenance Managers, and district Maintenance management shall complete the two-day SEMS Field Course (G 21431), which is provided under contract with the California Specialized Training Institute (CSTI).

- (4) Hazmat Managers and district management staff designated to report to the Regional Emergency Operations Center during an emergency shall attend the one day SEMS Emergency Operations Center (EOC) Course (G 21432) in addition to the Field Course. It is recommended that all Deputy District Directors, Maintenance attend this level of training.
- (B) Hazardous materials training will be provided to Maintenance personnel based on the duties and functions to be performed. Employees who are engaged in emergency response, no matter where it occurs, are required to take hazardous material training. (Permanent Intermittent, Limited Term, Temporary Assigned Duties and/or Retired Annuitants may be included in this category).

(1) First Responder Awareness Level

Caltrans field employees at the First Responder Awareness (FRA) level are those likely to witness or discover a hazardous substance release. They have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. They take no further action beyond notifying the authorities and isolating the area.

(2) First Responder Operations Level

Caltrans employees at the First Responders Operations (FRO) level are part of the initial response to the sites of potential and actual releases of hazardous substances. They are trained to respond in a defensive fashion without actually trying to stop the release. They attempt to identify the type of material from a safe distance, if it is possible to do so. They attempt to protect nearby people, the environment, and property from the effects of the release. They may attempt to contain the release from a safe distance, if it can be done without risk, to keep it from spreading and to prevent exposures. The FRO also ensures that notifications are made.

(3) Hazardous Materials Technician

Generally, Hazardous Materials Technicians assume a more aggressive role than a first responder at the operational level and may attempt to plug, patch, or otherwise stop the release of hazardous substances.

However, Caltrans employees trained at the Hazardous Materials Technician level shall not take any action that requires use of self-contained breathing apparatus. They shall not attempt to enter an area with an unknown substance that requires use of such equipment, or perform any other function that requires use of a self-contained breathing apparatus.

(4) Hazardous Materials Specialist

Generally, Hazardous Materials Specialists provide support to Hazmat Technicians. Specialists have more detailed and specific knowledge of hazardous materials than the technician level. If a technician is not present, a specialist is trained to perform the functions of a technician. A Hazmat Specialist can also act as site liaison with federal, State, local, and other government authorities in regard to site activities.

As with Hazmat Technicians, Caltrans personnel trained at the Hazardous Materials Specialist level shall not take any action that requires use of self-contained breathing apparatus. They shall not attempt to enter an area with an unknown substance that requires use of such equipment or perform any other function that requires use of a self-contained breathing apparatus.

(5) Policy regarding use of self-contained breathing apparatus:

Self-contained breathing apparatus shall be used only during formal specialist and technician training and refreshers, and during training exercises involving local emergency response agencies. Employees who take formal classes or participate in exercises must have undergone the appropriate respiratory function medical examination. Use of self-contained breathing apparatus is prohibited under any circumstances other than that described in this section.

Refer to Caltrans Safety Manual: Chapter 15 - Respiratory Protection Program.

(C) Training Requirements for Headquarters and District Hazmat Managers.

Headquarters and District Hazmat Managers shall attend the California Specialized Training Institute (CSTI) Hazardous Materials Specialist course.

They shall maintain competency by attending the CSTI Specialist Refresher annually, or by completing at least 24 hours of annual emergency response training equivalent to the CSTI Hazmat Specialist Refresher curriculum. Refresher training shall include curriculum related to emergency response operations, environmental compliance, hazardous materials, and hazardous waste laws and regulations.

In addition to the training described above, Hazmat Managers are recommended to attend a minimum of 16 hours of annual refresher training related to environmental compliance, hazardous materials, and hazardous wastes laws and regulations.

This requirement may be satisfied through attending University of California extension courses or those offered by private vendors. It may also be satisfied through attending Hazmat conferences that offer courses certified by the State Fire Marshall's Office. No portion of this requirement is satisfied through attending Hazmat Manager's meetings or Steering Committee meetings sponsored by the Caltrans Maintenance Hazardous Material Program, unless the meeting format includes a formal training module. Hazmat Managers will receive credit only for the time spent in the actual training session.

Hazmat Managers shall attend the CSTI instructor certification course, which qualifies them to teach the FRO course through the CSTI Outreach Program in the districts.

Instructors who do not teach at least four (4) hours per year will lose certification. Hazmat Managers who allow their instructor's certification to lapse shall attend the CSTI instructor course to renew their certification.

**(D) Training Standards**

No CSTI outreach instructor may delete any material contained in the CSTI curriculum.

CSTI requires that 100 percent of the CSTI Outreach Program course material be included in CSTI certified training programs. In addition, the courses may include Caltrans material.

The Headquarters Hazmat Manager shall operate an operational and training standards committee with members selected from District Hazmat Managers. The Headquarters Hazmat Manager will also select CSTI staff trainers to serve on the committee. The committee will support and supplement district training efforts.

See D5.10(B) for district personnel training requirements.

**D5.09 Actions Required by Districts**

Each district will take the following actions to comply with this chapter:

**(A) Contingency Plan**

Each district must prepare a Hazardous Spill Contingency Plan. Deputy District Directors, Maintenance shall provide annually the Chief, Division of Maintenance, a copy of the district's Hazardous Spill Contingency Plan. The Contingency Plan shall include the following:

- (1) Organization of response at the scene of a hazardous material spill.
- (2) Reporting and notification procedures.
- (3) Emergency response personnel.
- (4) Mitigation for highway spills and spills at Caltrans facilities.
- (5) Response to news media during incidents.
- (6) Contingency plans for incidents involving flammable or toxic vapors, fire and explosion, and hazardous materials (solid and liquid).
- (7) Contractors to be used by the district.
- (8) The District Hazardous Materials Spill Site Safety Plan.
- (9) The District Hazardous Materials Spill Cleanup Safety Plan (if applicable).

The District Hazardous Spill Contingency Plan shall be reviewed annually and updated as needed to reflect changes in personnel, information, regulations, local requirements, Departmental and district policy.

(B) Training of District Maintenance personnel

Chapter "D-5" shall be distributed to all District Maintenance personnel.

- (1) The following employees shall be trained to First Responder Operations (FRO) level and shall attend refresher training annually:
  - (a) All Maintenance Office Chiefs.
  - (b) All Maintenance Managers and Area Superintendents.
  - (c) All Maintenance Supervisors, including landscape and special crews.
  - (d) All Maintenance personnel responsible for communications dispatch.

In some districts, Traffic Operations personnel are responsible for communications dispatch. The Division of Maintenance strongly recommends that these dispatchers attend FRO training. Hazmat Managers will arrange for such training on request.

Training of others at the FRO level is optional.

- (2) All other field Maintenance employees shall attend the First Responder Awareness (FRA) Level training annually.
- (3) Districts shall provide the Hazardous Material Operations' Manager annually with schedules of planned training. Schedules are due no later than May 1<sup>st</sup> for training held the following fiscal year. The Hazardous Material Operations Manager may attend training in the districts to provide updated information and to monitor course standardization.

See D5.08 above for detailed descriptions of hazardous materials training levels.

- (C) Actions to be taken by the employees first at the scene of a hazardous material spill.

There are four (4) basic steps all employees will take when confronted with a suspected spill:

- (1) Approach the site safely. Always use the “buddy system.” Observe the situation and conditions.
- (2) Isolate the area. Provide for traffic control, closing a lane or entire road if necessary. Do not leave spill site unattended.
- (3) Make appropriate notifications, following district procedures. The District Hazmat Manager must be notified of suspected hazardous materials spills.
- (4) Perform identification and hazard assessment within their capabilities. This must be confirmed by a person trained to at least the FRO level before further action is taken.

- (D) Documentation by the FRO at the scene of a hazardous material spill.

A Caltrans employee at the leadworker level or above who is trained to at least the FRO level shall take appropriate action as described in this chapter. Each situation is unique and will require the FRO to use his or her judgment, based on FRO training standards. The Hazmat Manager shall provide guidance to FROs in performance of their Hazmat-related duties.

Unless directed otherwise, the FRO will do the following to document the spill:

- (1) Attempt to secure responsible party identification from CHP or local police involved.
- (2) Complete a Spilled Substance Report (DM-M-164) and enter information into the Spill Info tab on the IMMS Service Request form.
- (3) Prepare a Spill Narrative and enter information within IMMS on the comments tab.
- (4) Complete a Hazardous Spill Diary Form (DM-M-157).
- (5) Ensure that a California Uniform Hazardous Waste Manifest is prepared.
- (6) Note the Assigned IMMS Service Request Number on the Spill Diary Form (DM-M-157) and complete all required data fields in IMMS.
- (7) Ensure a Site Safety Plan is prepared prior to initiating cleanup operations.

**(E) Role of the District Hazmat Manager**

First responders shall notify the District Hazmat Manager early in the incident notification phase.

The District Hazmat Manager will:

- (1) Coordinate with other agencies, contractors, the spiller, and Caltrans responders concerning the best contractor or subcontractor to call.
- (2) Review all IMMS documentation and note completion by checking the Spill Packet Complete and Hazmat Manager review box.
- (3) Input all Emergency Spill Contractor costs in the Work Order Extra Item tab within IMMS.

**(F) Contract Management**

District Hazmat Managers are contract managers for Maintenance for highway spills that occur in the districts. See the Maintenance Hazmat Contract Manager's Handbook for detailed instructions.

(G) Choice of Contractor

When an immediate danger to life, health, or the environment is eminent an Emergency Spill Contractor will be called out in accordance with the terms of the current executed contract.

(H) Cleanup of Known Hazardous Materials by Caltrans Personnel

- (1) Caltrans personnel may clean spills of working stock and known hazardous materials only if all conditions are met:
  - (a) Employees are trained in the potential hazards and proper handling of the material through review of the Material Safety Data Sheet (MSDS), other pertinent product information, the appropriate Code of Safe Operating Practices (CSOP), and the District Contingency Plan.
  - (b) Employee exposure to the material is minimized.
  - (c) Employees are equipped with and use the personal protective equipment specified in the MSDS, product information, or CSOP, such as impervious gloves, boots and eye protection.
  - (d) An appropriate spill Site Safety Plan shall be completed and attached to the Spill Report for spills on the right of way.
  - (e) Entry into the area does not require use of a self-contained breathing apparatus.
- (2) The cleanup of gasoline spills on the operating right of way using Caltrans personnel is not recommended. If it must be done the following conditions must be met:
  - (a) The cleanup method involves no contact with the liquid or vapors.
  - (b) The spill occurs in a well-ventilated outdoor area.
  - (c) Employees shall work upwind from the spilled material.
  - (d) Cleanup methods will produce no sources of ignition.

(I) Hazardous Waste Resulting from Spills

(1) Temporary storage of hazardous waste

District Hazmat Managers should identify several holding sites where fuel contaminated soil and other hazardous waste resulting from highway spills can be hauled for temporary storage. This will speed the process of opening traffic lanes after a spill.

In some areas, Caltrans must acquire local regulatory approval for such storage. The District Hazmat Manager shall ascertain if such approvals are necessary.

(2) Waste disposal

Districts should evaluate the available options and select the most cost-effective method of waste disposal. These options include transporting the waste to a commercial recycler, to an incineration facility, or to a landfill. Use of landfills should be considered only when other options are not available or practical.

Removal of waste resulting from a highway spill when defined as non-emergency, where digging and excavation are not required and when a responsible party can not be identified shall be removed through the "Milkrun" contract as a cost effective method. Highway spilled waste shall at no time be co-mingled within the same containers as Caltrans self-generated waste. Waste containers are to be uniquely identified as a highway spill material using a county specific EPA ID number. Manifest documentation is required separate from Caltrans self-generated waste.

(J) Process for submitting contractor's invoices for payment.

Refer to the Maintenance Hazmat Contract Manager's Manual for instructions regarding use of the statewide spill contract.

Processes for approval and submission of contractor's invoices vary in the districts. The District Hazmat Manager can provide detailed information regarding each district's process. The District Hazmat Manager is responsible for reviewing all spill documentation prior to submittal to HQ Accounting.

(K) Documentation and Records

- (1) Copies of the following documents must be submitted to the Division of Maintenance attention: Hazardous Material Operations:
  - (a) Reports of all hazardous spills (Spilled Substance Report DM-M-164)
  - (b) Receiving records
- (2) In addition to the above documents, the following must be maintained on file by the District Hazmat Manager and may be requested by the Hazardous Material Operation's Manager:
  - (a) Spill Narratives
  - (b) Hazardous Spill Diary Forms (DM-M-157) and Site Safety Plan, if applicable
  - (c) Completed copies of California Uniform Hazardous Waste Manifests
  - (d) IMMS Service Request Numbers (Identifies all associated Accident Damage Reports
  - (e) Proposition 65 notification reports
  - (f) Invoices and all back-up documentation.

**D5.10 Monthly and Annual Reports**

The Maintenance Program provides oversight of all district highway spill activities. District Hazmat Managers shall maintain the IMMS database for spill information and expenditures by fiscal year.

District Hazmat Managers shall ensure that the IMMS database has complete and correct information for hazardous spills. Monthly corrects and/or input shall be completed by the first of the month after the spill occurrence.

Information included in the reports is used to compile the statewide annual spill report and to provide up-to-date reports as needed. Upon request, Hazardous Material Operations creates reports for Caltrans and Agency management, Caltrans Public Affairs, the Legislature, other State departments, and the public.

Annual reports shall be submitted to the Hazardous Material Operations' Manager by July 15 for the previous fiscal year. Reports shall be submitted electronically. Districts may track information additional to that required on IMMS. At the request of the Hazardous Material Operations Manager, the districts may be required to submit other annual reports.

Districts must include the following information in their report to The Hazardous Material Operations' Manager:

- |  |   |
|--|---|
| (A) County   | (I) Hazardous class (see Emergency Response Guide)              |
| (B) Route  | (J) Method of cleanup (Caltrans, responsible party, contractor) |
| (C) Post Mile                                      | (K) Name of Emergency Spill Clean-up Contractor                 |
| (D) Spill Date                                     | (L) Whether there was direct billing                            |
| (E) Time   | (M) Invoice number  |
| (F) Material spilled                               | (N) Amount of invoice   |
| (G) Quantity spilled                               | (O) Service Request number                                      |
| (H) Units (pounds, gallons or metric measurements) |   |

Figure D5-1: Reporting Information

# **CHAPTER E**

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APPENDIX E-A Glossary of Plant and Pruning Terms

Original signed by  
Sheree Edwards  
Office of Roadside  
Division of Maintenance

## **E.00 Introduction**

This chapter explains the maintenance of landscape vegetation planted within the State highway right of way. Work includes irrigation, planting, plant removal and replacement, washing, pruning, fertilizing, weed and pest control, and growth retardants. Appendix E-A is glossary of plant and pruning terms and can be found at the end of this chapter.

Aesthetics, safety concerns, and functional requirements are involved in highway landscape planting. Landscaped areas should be maintained as originally designed and planted unless experience indicates otherwise. Plantings require a degree of maintenance consistent with:

- (A) The original design
- (B) Vehicle, bicycle and pedestrian safety
- (C) Use of adjoining property
- (D) Availability of funds

Highway landscape plantings are designed to serve several functions. Lineal or mass plantings can be established for aesthetic improvement and can also effectively serve as screening of traffic from adjacent properties.

A fully landscaped planted area, such as with trees, shrubs and ground cover, provides traffic screening, helps preserve property values of adjacent development, and improves aesthetic values of local communities' rights of way. Planted groundcover provides both aesthetic value and improves the stability of roadside slopes.

For charging practice instructions, see "E" Family of the Maintenance Manual Volume 2.

## **E.01 Policies**

Maintain landscape areas as designed.

- (A) If changes in design are needed, they must be approved by the District Landscape Architect.
- (B) If the need for altering landscape design is required because of transients living in the landscape area, the District Landscape Architect must pre-approve the design changes, and may seek community input.

All tree pruning shall be consistent with the current ANSI A-300 standard. A copy of the standard is available from your District Landscape Specialist or Headquarters Maintenance, Office of Roadsides.

- (A) Pruning low lateral branches off shrubs and trees is prohibited without prior approval by the District Landscape Specialist or District Landscape Architect. Lower limbs should not be removed or raised enough to allow weeds to grow or trash to accumulate under plants. There may be certain landscape areas where this policy may be altered to accommodate homeless and transient concerns, security, and fire issues.
- (B) Shrubs in mass plantings should not be pruned as individual plants.

Caltrans promotes water conservation as a continuing practice. Water conservation is accomplished in landscape irrigation through water management. Appropriate water management accommodates the landscape's actual water needs sufficiently to maintain healthy growing plants.

- (A) Caltrans should comply with local agencies' water conservation guidelines for watering times and use. During drought conditions, it is important to find out the local agencies' watering practices recommendations.

Plantings should be grown to achieve healthy, mature plants. Thereafter, maintenance operations should be limited to those necessary to maintain a healthy planting.

## **E.02     Irrigation Systems**

### **E.02.1             Water Conservation and Management**

To determine water needs, consider the following site conditions: plant species, age of plants, temperature, wind, length of day, soil type (sand, silt or clay), slope, slope orientation, and ecotype.

Transpiration is the process by which plants pass water from their leaves to the atmosphere. The term evapo-transpiration (ET) describes the amount of water that is taken up and used by the plant through transpiration and evaporation. Reference evapo-transpiration (Eto) is measured in inches for water requirements of plants by species. Plant coefficients (Akc) are the estimated percentages of Eto that a species needs to maintain good health. For information on irrigation, refer to the Department's Roadside Vegetation Management Handbook under Irrigation Management.

Overwatering is to be avoided. Water penetration should thoroughly wet the plant root zone. Water running into gutters and drains is wasted and indicates water is being applied too fast to be absorbed into the soil or too long after the soil is saturated. On slopes, short irrigation cycles should be repeated to minimize water runoff and maximize water percolation. By minimizing irrigation runoff at all times, stormwater concerns can be alleviated.

Automatic irrigation controllers have many advantages to keeping the landscape irrigated. However, controllers are only as good as their operators, and will need to be reprogrammed seasonally. The systems should not run during rainy weather.

Automatic irrigation systems with overhead spray heads should be programmed for night watering between 8 p.m. and 6 a.m. Watering times should be adjusted, where needed, to eliminate irrigation during heavy commute hours. Overhead watering in the heat of the day should be avoided since some plantings are susceptible to leaf scorch.

Favorable public perception is important to the Department's irrigation management practices. Therefore, it is extremely important that landscape irrigation water is managed wisely. During the irrigation season, frequent inspections are important to ensure that water breaks are repaired in a timely manner. Water breaks also raise stormwater concerns.

Reclaimed water use requires the same quick repair response as potable water. In areas where riser damage frequently results in geyser-like breaks, in-line flow shutoff devices should be used. The use of pop-up sprinklers should be considered to eliminate continuing problems. Changes can be recommended by the District Landscape Architect.

For assistance on water conservation and plant water needs, contact your District Landscape Specialist.

#### **E.02.2 Backflow Preventers**

Backflow preventers shall be tested and certified annually by a person who has a certificate issued by the agency having local jurisdiction, for example: water districts, cities, etc. This testing can be done by a certified Caltrans employee or by a certified contractor who possesses a valid license.

Prior to performing any testing of devices, testers must be familiar with the regulations of local agencies, cities, and counties in their area, including any special qualification requirements that may apply, and documentation that must be completed.

**E.02.3          Irrigation Controller Management**

Automatic irrigation controllers are to be kept clean, rust-free, and in good working condition.

- (A) Controller cabinet bases must be free of vegetation that contributes to rusting.
- (B) Cabinet lids should have a secure lock and be maintained to eliminate intruding water.
- (C) Insect and rodent control may be necessary to eliminate wire and component damage.
- (D) Seasonal irrigation schedules should be posted inside each cabinet and copies made available at the Supervisor's office.

The District Landscape Specialist should be contacted for assistance in programming automatic controllers.

Remote Irrigation Control System (RICS) is the latest technology used in irrigation management. With RICS, the water manager can operate the entire system from a base station linked to field controllers in their area. Irrigation schedules can be altered as conditions change. Irrigation can be turned off on rainy days. The system can detect a broken water mainline and shut down the system at the master control valve. The next morning, the water manager is notified of the problem and repairs can be scheduled. The central controller system increases efficiency and conserves water.

Please refer to the Department's Roadside Vegetation Management Handbook in the Irrigation Management section under Central Controllers for more information.

**E.02.4          Irrigation Pumping Facilities**

Irrigation pumping shall be inspected and serviced weekly during the watering season.

**E.02.5          Freeze Protection**

All backflow preventers, valves, and exposed plumbing shall be drained and/or covered adequately to prevent damage from freezing during the cold weather months. The material used to insulate the plumbing devices must be installed in a manner so it stays dry. (Wet insulation will freeze and will not protect the irrigation equipment).

**E.02.6          Irrigating Plants**

Young plants with fewer, shallower roots require more frequent watering than older, established plants.

As a rule, shallow-rooted plants, such as lawns and certain shrubs, require frequent watering for short periods of time. Deep-rooted plants, such as many trees and shrubs, require less frequent but deeper watering.

Areas watered by an automatic irrigation system should be programmed to minimize water runoff. Familiarization with the automatic irrigation system equipment is important to maximize the benefits of the system. Special attention should be given to watering areas under highway structures, which do not get naturally watered by seasonal rainfall.

Generally, drought tolerant native trees and shrubs require less water once they become established. Rainfall is all that some native plants require after the first few years of establishment. During the establishment period, native plants should be watered only as often as recommended.

Weak wood, excessive top growth, and/or destructive fungi may result from over-watering. Weak, succulent growth on plants also cannot withstand winter frosts.

**E.03          Plantings**

**E.03.1          Tree Inspection**

Conduct visual surveillance, to extent reasonable, to detect trees and limbs which may be a hazard to traffic, pedestrians, highway appurtenances, electric utility lines, and adjacent property.

Conditions such as loss of root support, interior-rotting, and split limbs can be hard to detect.

**E.03.2          Vegetation Control**

Weeds and grasses must be controlled to the extent that they do not become damaging or present a fire hazard to ornamental plantings.

Control of vegetation along fence lines is necessary to protect the State's investment and also provide a neat finish to other roadside vegetation.

Plantings of trees and shrubs that are, or will become, too close to the edge of pavement or right of way fence should be controlled.

Trees should never be planted in the clear recovery area. Such plantings should be selectively thinned or removed entirely, especially if the remaining plants will spread and replace the original foliage that is removed. Consult with your District Landscape Specialist and District Landscape Architect before removing trees or shrubs.

Groundcover should be controlled to prevent undesirable spreading into drainage facilities, pathways, sidewalks, bicycle trails, shoulders, plant basins, fences, tree wells, ornamental plantings, and other areas where groundcover is not desirable.

#### **E.03.3 Plant Removal/Replacement**

Overcrowding of plants can occur as plantings mature. This condition requires a thorough study before thinning and should be accomplished jointly between the Landscape Specialist and the District Landscape Architect.

- (A) The removal of front row shrubs next to the roadway allows the second row to develop naturally. This is preferable to saving both rows at the cost of frequent and unsightly pruning of the original first row. Similarly, fence line row of shrubs can also be overcrowded.
- (B) Dead ornamental trees and shrubs within the right-of-way should be removed, including chipping, hauling the brush, and removing or grinding the stump.
- (C) To reduce slippery conditions on pavements, trees or shrubs located in areas subject to snow and icing conditions should be removed, where feasible, to expose pavement to wind and sun.
- (D) Plants destroyed in vehicular crashes should be replaced in like size and kind. Replacements should not be made if adjacent plant growth will fill open spaces left by missing plants within a reasonable time.
- (E) Specific sites with homeless and security concerns may warrant the need for plant removal.

The District Landscape Architect and District Landscape Specialist shall approve all design changes.

#### **E.03.4 Inspection of Nursery Stock**

Upon receipt of any nursery stock, check the shipping permit. Plants shipped within a county that has a certificate of inspection and release, an exemption tag, or plants that have an inter-county nursery stock certificate do not have to be held for inspection.

Notify the County Agricultural Commissioner and have the plants inspected before planting if they do not have proper tagging. Check nursery stock closely for quality and adherence to nursery standards before acceptance. All plants shall be healthy, shapely, and well-rooted. Roots shall show no evidence of having been restricted or deformed at any time. The stems or trunks of trees shall show no signs of having been cut, broken, mutilated, scraped, girdled, or restricted by plant ties or supports.

Plants shall conform to nursery standards, be free from insects, pests, and diseases and shall be grown in nurseries inspected by the State Department of Food and Agriculture.

Inspect plants either prior to or upon delivery. If it is determined by Caltrans Landscape personnel that any plant is rootbound or is in any way not acceptable, that particular plant shall be rejected, and must be replaced with an acceptable.

#### **E.03.5          Planting Containerized Stock**

Containerized nursery stock requires daily watering during hot, dry, or windy weather.

Planting holes for trees or shrubs from canned or balled stock should be at least twice the diameter and 6 inches deeper than the plants rootball. These holes are to be back-filled with native soil or topsoil.

Place the rootball in the hole at a depth equal to its original container height. The hole must be back-filled and watered immediately. Compost may be evenly mixed with backfilled soil around containerized stock and used on the surface as mulch.

It is good practice to not remove containers until the time for planting. Early container removal often allows roots to dry on the outside of the ball, resulting in plant injury.

Roots encircling the rootball should be cut and evenly spread out in the planting hole. Do not destroy the rootball, either in root handling or during planting operations.

When transplanting trees or planting trees from 15-gallon container size or larger, consider the use of vitamin and/or hormone-type materials and anti-transpirant materials to prevent shock.

**E.03.6          Planting Bareroot Stock**

Some deciduous plants can be transplanted bareroot during their dormant period. This period is during the winter when the plant is without foliage and translocation of plant foods is at a minimum due to cooler temperatures. Bareroot stock must be kept cool, and the roots must be kept moist during the period of removal from the nursery row to final planting. This is commonly done by "heeling-in" the roots in moist sand or wood shavings in a protected location.

Planting holes should be large enough to accept the roots without doubling or bending. The soil should be loosened well below the root area. Topsoil or native soil is placed on the bottom of the hole prior to planting.

Damaged roots should be cleanly removed.

When planting the bareroot plant, the roots should be spread naturally and back-filled with topsoil and/or native soil, keeping the crown of the plant as high as it was originally. Do not tamp the soil around the roots. It should be washed in with water and the soil gently poked to eliminate air pockets and to settle the soil. Mulch may be placed on the surface, but not mixed into the planting hole.

Stakes, if used, should be placed after the tree roots are located in the hole and prior to back-filling to avoid root damage.

**E.03.7          Tree Stakes and Ties**

It is best to buy trees that will not require stakes and ties.

Tree ties should be checked and loosened as the tree trunk expands, or replaced as old ties break or wear out. A material such as tree tape, plastic, or rubber belting makes a desirable tie when looped around the tree in a figure eight, and fastened to the stake securely. Enough room should be left for the trees to move and grow.

Ties should be placed as low as possible on the tree to provide support, yet allow the main trunk to flex naturally. When the tree no longer requires support, the stakes and ties should be removed.

**E.03.8          Mulching Plants**

Conservation of soil moisture and weed prevention in planted areas may be accomplished by the proper use of mulch materials. Wood chips, green waste, shredded bark, compost, and/or sheets of landscape fabric may be used to cover the ground around and between plants.

Wood chips and shredded bark are often available from district tree crews or from local cities, municipalities, utility companies, recyclers, lumber mills, and arborists. Only accept and use clean mulches. Do not use mulches with trash, plastics, heavy metals, poisonous shredded plants, construction wastes, or obvious undesirable plant seeds. Leafy material in mulches should be kept to a minimum, since leaves harbor more diseases than bark does. Prevent mulch from burying plant trunks. Mulch touching tree trunks can cause crown rot and kill the plant. Keep mulch a minimum of six (6) inches away from all trunks.

**E.04          Tree and Shrub Maintenance**

**E.04.1          Caring for Young Trees**

Tree care during the first few years can have a noticeable effect on their economical establishment and usefulness. The most appropriate means of growing a young tree to a useful size is with minimum pruning. Prune out only branches that cross. Do not top. Shape only when necessary.

**E.04.2          Irrigating Young Trees**

Trees are generally planted by contract along Caltrans roadsides in amended soil with slow release fertilizers before being accepted by Caltrans. Regular watering may be required depending upon the plant species, local growing conditions, slope aspect, and climate. Some species in some locations may always require watering during the dry season. Watering should be gradually tapered off as trees mature. Do not over-water native or drought-tolerant trees.

**E.04.3          Fertilizing Young Trees**

There is a wide selection of types of fertilizers for a variety of specific uses, along with differing formulas.

Every fertilizer's label shows, in numbers, the formula of major nutrients (N-P-K). N-P-K stands for the formula of nitrogen (N), phosphorus (P), and potassium (K). Macro- and micro-nutrients may also be included.

Fertilizers are available in dry or liquid form. There are further differences between complete, simple, special-purpose and organic fertilizers. In addition, there are differences between controlled release, tablet, and combination products.

Due to California's many ecotypes, elevations, climates, and soils, each planting area dictates its own fertilization needs. Typically, native plants thrive without fertilization. However, ornamental plantings typically require some fertilization on a continuous basis to ensure health and vigor.

Consult with your District Landscape Specialist and District Landscape Architect if a loss of plant health and vigor is present.

#### **E.04.4 Fertilizing Young Shrubs and Groundcovers**

Newly planted shrubs and groundcovers should be fertilized only after new growth indicates the plant is established and capable of using fertilizer. The lack of vigorous growth and deep green coloring in the foliage of a plant is one indication of the need for fertilizing and is prevalent in locations with poor soil fertility. Poor drainage, insufficient water, root diseases, and/or hot weather may result in similar symptoms.

Nitrogen is the element that is most needed in California soils and should be replaced frequently due to its instability.

### **E.05 Controlling Pests and Disease**

#### **E.05.1 Eucalyptus Longhorn Borer**

The adult Eucalyptus Longhorn Borer is a 1-inch long, dark blackish-brown beetle with cream-colored zigzag-shape on its back.

The larvae grow to 1½ inches long and feed on the under-bark of the eucalyptus tree. Eucalyptus Longhorn Borers do extensive damage to the tree and may kill it by girdling the trunk.

The adult emerges in late April throughout the spring and summer months. The insects prefer to lay their eggs in trees that are stressed and weak. They also prefer areas of fresh cut limbs and logs.

Things to do to stop the spread of this insect:

- (A) Eucalyptus trees should be kept healthy by periodic irrigation during drought conditions.
- (B) Trees should be pruned and trimmed during the winter and early spring months when adults are not active and nighttime temperatures are at or below 50° F.
- (C) Infested wood should be buried, chipped, or solarized (wrapped in plastic for a minimum of six months).
- (D) Infested trees should be removed. Wood and trimmings should be disposed of by burning (where legal to do so), burying, chipping, or solarization (wrapping in clear plastic for six months).
- (E) Eucalyptus wood or trimmings must not be moved out of the area.
- (F) If the beetle or its larvae is seen, contact your local County Agricultural Commissioner, the California Department of Forestry, or the California Department of Food and Agriculture.

#### E.05.2 Pine Pitch Canker

Pine Pitch Canker is a fungal disease of pines. Monterey pines and Bishop pines are especially susceptible, although other non-native and native California pines can also become infected. It exists in 14 coastal and adjacent inland counties from San Diego to Mendocino.

The disease is spread by insects that have become contaminated by the fungus. Pine Pitch Canker can also be spread by transporting infected trees and tree parts and using contaminated tools.

Infected seeds and seedlings may initially appear disease-free, but may later develop disease symptoms.

It is important to be aware and follow local agency, California Department of Forestry, and Food and Agriculture Department's recommendations for cutting, transporting, and handling infected trees/parts. Things that can be done to prevent spreading this disease are:

- (A) Know if you are in an infested area. Be able to recognize the disease.
- (B) Realize the disease can be spread by transporting tools, any tree parts or waste and seeds/seedlings. Always follow recommendations provided by your local County Agricultural Commissioner for proper tool treatment. Clean and sanitize tools before going into a non-infested area.

- (C) Contaminated materials should not be transported into a disease-free area.
- (D) Infected material/trees should be removed and destroyed by burying, tarping, burning, or chipping. Tarping must be for six (6) months under clear plastic.
- (E) Plant material should be covered when taken offsite.

#### **E.05.3          Red Imported Fire Ants**

Imported red fire ants are aggressive, reddish brown to black ants that are 1/8 to 1/4 inch long. They construct nests that are often visible as dome-shaped mounds of soil, sometimes as large as 3 feet across and 1-1/2 feet in height. In sandy soils, mounds are flatter and less visible. Fire ants usually build mounds in sunny, open areas such as lawns, pastures, cultivated fields, and meadows, but they are not restricted to these areas. Mounds or nests may be located in rotting logs, around trees and stumps, under pavement and buildings, in electrical cabinets, and occasionally indoors. When fire ants nests are disturbed, numerous fire ants will quickly run out of the mound and viciously attack any intruder. These ants are notorious for their painful, burning stings that result in a pustule and intense itching, which may persist for 10 days. Infections may occur if pustules are broken. Some people have allergic reactions to fire ant stings that range from rashes and swelling to paralysis or anaphylactic shock. In rare instances, severe allergic reactions cause death.

Fire ants may infest irrigation controllers and electric valve boxes. They are usually smaller than local ants. Fire ant infestations are typically found in the southern half of the state, but will probably spread to the rest of the California.

Contact your local County Agricultural Commissioner if you suspect fire ants in any location.

#### **E.05.4          Oleander Leaf Scorch**

Oleander Leaf Scorch (OLS) is a relatively new disease that was first discovered in the 1990's in Riverside County. Although primarily a southern California disease, OLS is spreading rapidly and is a serious concern to those in agriculture and government.

OLS is caused by the bacterium *Xylella fastidiosa*, which is the same species (although a different strain) that causes Pierce's Disease, Almond Leaf Scorch, and Phony Peach Disease. OLS strains of *Xylella fastidiosa* infects periwinkles and oleanders. The blue-green sharpshooter and the glassy-winged sharpshooter vector the OLS bacterium. Oleanders affected by the disease decline and then die, usually within three to five years of the first symptoms. There is no known cure, either with chemicals or cultural methods.

OLS is readily (and quickly) transmitted by the sharpshooter (an insect). OLS symptoms begin with yellow margins or spots on the oleander leaves before the edges and tips take on a scorched appearance. Then twigs and branches die-back. The bacteria clog the xylem (water-conducting tissue) of the oleanders, cutting off water supply to the leaves. Symptoms of oleander leaf scorch may be confused with symptoms of water stress, chemical damage, or plant burn.

When a sharpshooter feeds on a plant that is infected with *Xylella fastidiosa*, it acquires the bacteria, which then multiplies within the insect's mouthparts. The sharpshooter then transfers the bacteria to another plant when it feeds. In addition, high temperatures will more quickly stress and kill infected plants. Current research indicates the 'Ruby Lace' variety of oleander does not seem to die as quickly as the 'Hardy Pink' and the 'Hardy Red' oleander varieties.

Pruning out the part of the oleander plant showing symptoms may help the appearance (aesthetics) of the oleander, but pruning will not save the plant. The bacteria have already moved throughout the plant, and the limbs that show symptoms are only the first to be affected. However, pruned plants may be able to survive longer than those left un-pruned. Always sanitize your pruning tools by dipping in a 10% bleach solution.

Glassy-winged sharpshooters' low flying pattern may help oleanders in medians. Sharpshooters have a natural tendency to fly between 3-16 feet above the ground.

#### E.05.5 Sudden Oak Death

The tree disease known as Sudden Oak Death (SOD) is caused by a mold-like microscopic pathogen called *Phytophthora ramorum*. The pathogen infects several species of native oaks in California, creating cankers under the bark of the trunk. Beetles and decay fungi often further colonize infected trees, which may lead to a rapid weakening of the tree and eventual death. SOD also infects a number of other species in California's woodlands though the symptoms on these species are milder, usually only leaf spots and twig die back, and typically not fatal. How SOD is spread is not yet totally known. Research (during 2001-2005) has shown that *Phytophthora ramorum* can be spread from plant to plant via wind-driven rain, the movement of soil and water, and by moving infected plant parts, especially infected leaves of foliar plant hosts.

Researchers are also studying if *Phytophthora ramorum* can be spread in the air or if some animals may help disperse spores. For the disease to be spread, the transported *Phytophthora ramorum* must successfully infect an uninfected host plant.

Things to do to stop the spread of SOD:

- (A) Know if you are in an infested area.
- (B) Be able to recognize the disease.
- (C) SOD can be spread by transporting tools, any tree parts, wastes, and firewood.
- (D) Treat pruning tools before using them to trim non-diseased plants. Contact the local County Agricultural Commissioner for the latest treatment procedures.
- (E) Leave as much plant material as possible onsite, especially leaves and branches less than 4" in diameter. This material can be chipped and left as mulch.
- (F) Transport material that must be removed to an approved SOD collection or disposal site within the same county. Check with your local County Agricultural Commissioner for approved locations.
- (G) Obtain the needed Compliance Agreement from the County Agricultural Commissioner before moving SOD material outside of regulated areas.

#### E.05.6 Eucalyptus Red Gum Lerp Psyllid

In June 1998, eucalyptus trees along the freeway in El Monte, in Los Angeles County, were found heavily infested with an unknown insect. Samples were taken and the insect was identified as the lerp psyllid (*Glycaspis brimblecombei*). In less than a year, the lerp psyllid's presence was reported in many other California counties. The lerp psyllid (an Australian insect) severely defoliates some species of eucalyptus trees, and over time, the tree dies.

The lerp psyllid attacks eucalyptus leaves. The wingless, yellowish immature form (nymph) secretes a waxy protective conical cover, called a lerp. The nymph sucks the juices from the leaf, which kills the leaf and the leaf falls off. The insect has since moved to another nearby leaf to grow and lay eggs on more leaves. The nymphs also secrete large amounts of sticky honeydew on the eucalyptus leaves. This results in blackened foliage due to the growth of sooty mold. Lerp psyllids prefer new growth, but can be found on all foliage parts. High lerp psyllid populations on eucalyptus species normally result in withering and dropping of the leaves. Through the tree's stored energy, it puts out new growth (leaves) and the insects begin to feed on them. The eucalyptus tree can only put out new growth a few times, until all of its reserved energy is used up. Eventually, repeated dieback causes the death of weakened trees.

The lerp psyllid infects over two dozen eucalyptus species. There are three eucalyptus species easily infected and heavily used on California roadways. These species include the Red River Gum (*Eucalyptus camaldulensis*), Red Ironbark (*Eucalyptus sideroxylon*) and White Ironbark (*Eucalyptus leucoxylon*). The species of eucalyptus is the primary determinant of whether lerp psyllids will be abundant. Cultural practices and overall tree health may also influence lerp psyllid populations.

Psyllid-specific parasites were introduced in 2003 in an effort to provide biological control as a long-term solution. At least one psyllid-specific parasitic wasp (*Psyllaephagus bliteus*) has been introduced from Australia. The tiny female wasp lays its eggs inside the lerp psyllid nymphs.

Because of the lerp psyllid's exponential population growth and ability to fly, this little insect has literally spread throughout California in less than seven (7) years. Many groves of eucalyptus are diseased and dying along Caltrans roadways. Entomologists are optimistic that the parasitic wasps will spread throughout the state and stop the widespread devastation.

## **E.06      Groundcover Maintenance**

### **E.06.1          Caring for Groundcovers**

Older landscaped areas tend to utilize iceplant and/or ivy extensively over large areas. Newer landscaped areas tend to have smaller groundcover planting areas with a much wider variety of groundcover species. (Groundcover species currently planted include myoporum, lantana, trailing manzanita, prostrate coyote brush, trailing rosemary, creeping St. Johnswort, trailing African daisy, trailing acacia, groundcover roses, gazania, star jasmine, vinca, cape honeysuckle, plumbago, bougainvillea and honeysuckle). Although many groundcovers are relatively hardy, they still require periodic care.

Every groundcover species has different needs and requirements, so maintenance should be tailored specifically to the plant species. Maintenance includes watering, fertilizing, weeding, mulching (until the groundcover fills in), trimming, and edging. Occasionally, insect and rodent control may be necessary. If you are unclear about specific groundcover care, consult with your District Landscape Specialist.

### **E.06.2          Edging Groundcovers**

Groundcovers must be edged to preserve highway safety when encroaching into the traveled way. Groundcovers should also be edged when necessary around highway facilities (such as drain ditches and fences). Chemical treatments should be considered since they are more economical (providing the correct type of material is chosen and the application is timed correctly).

Growth retardants may be used to retard the growth rate of groundcovers, thus reducing the need for manual trimming and/or chemical edging.

Do not use systemic or translocating types of herbicides.

A contact material, which kills only the parts sprayed, may be chosen. It should also be one that does not stain curbs, gutters, fences, or the sprayed groundcover. Spraying is a faster operation than cutting and removal; however, spraying must be done as frequently as is necessary to prevent excessive encroachment into traffic, since the dead tips will be left in place. A hydraulic, cab-operated spray bar is available for edging groundcovers. Always follow your District Landscape Specialist's recommendation.

#### **E.06.3          Controlling Weeds in Groundcovers**

Caltrans implements Integrated Vegetation Management (IVM) methods for weed control in groundcover plantings. Successful IVM strategies for groundcover weed control include manual, cultural and chemical.

Manual weed control techniques for weed control in groundcover plantings include hand pulling, hoeing, and using hand-held power equipment (such as string trimmers and walk-behind mowers). Manual weed control may be the best method for removing thick, weed-choked areas in established groundcover plantings. Typically, manual weed control is the most labor intensive IVM method.

Cultural weed control techniques for groundcover areas include mulching, proper watering/irrigation, correct fertilization, successful pruning and shaping, and other proper horticultural practices. A 4 to 6-inch layer of weed-and-trash free organic mulch can be effective at controlling weeds. Mulches also help with breaking down the force of water droplets, insulating the soil from harsh effects of heat and winds. Mulch decomposes within a few years and should periodically be reapplied. Placing landscape fabric (which allows air and water to pass through) on the soil, prior to applying mulch, also helps prevent weeds. Ensure that mulches remain onsite, as they may travel into roadways, drainage pathways and water courses.

Proper horticultural practices help groundcovers remain healthy and vigorous. Healthy ornamental groundcover areas can crowd out nearby weed species. Chemical weed control in groundcover areas is the application of herbicides. Chemical applications must be properly timed, using the correct rate, adhering to proper spray techniques and using the best selective herbicide for the groundcover and weed species at the site. Chemical applications can be the most effective IVM methods for controlling weeds in groundcover plantings.

In many locations, chemical applications are the most economical IVM method. Please refer to the Herbicide List in Chapter "C", Vegetation Control.

Before using chemical IVM methods, a recommendation is required by your District Landscape Specialist. Always wear your Personal Protective Equipment (PPE).

Combining several IVM methods can provide an effective, long-term weed control strategy for existing mature groundcover areas. A typical combination of IVM methods may include manually removing existing weeds in an established groundcover planting. After new weeds sprout (germinate), apply a post-emergence chemical application to kill the new weeds. Lay down some landscape fabric and apply a 4 to 6-inch layer of organic mulch. Proper horticultural techniques will allow the groundcover to grow vigorously. The area should fill in with groundcover, and the planting will have fewer weeds. Consult with your District Landscape Specialist to ensure the best combination of integrated vegetation methods are being used, in the correct order, to enhance your specific site.

See Herbicide List, Chapter “C”, Vegetation Control.

## **E.07     Lawn Maintenance**

### **E.07.1            Caring for Lawns**

Lawn care on highway projects should be consistent with the purpose of the original planting. An area restricted to high-speed automobile traffic may be maintained at a lesser standard than an area with pedestrian traffic.

In areas observed by pedestrians or slow traffic, walks and curbs should be edged frequently. Weeds should be eliminated from cracks, and gutters should be cleaned.

### **E.07.2            Mowing Lawns**

Lawns should be mowed to a height determined by the variety of grasses and intended purpose.

Since consistent appearance with a minimum amount of care is the requirement of a highway lawn area, the height of mowing is of prime importance. Taller lawn blades are preferred. A taller turf height allows ample food producing surface to support a healthy root system. It also protects the soil surface from exposure to the hot sun, and tends to prevent weed growth in the turf. Lawns are dependent upon their foliage for the manufacture of their food.

A closely clipped lawn will maintain its health and beauty only if artificially fed calculated quantities of fertilizer. Without extra feeding, the root system will be shallow and incapable of obtaining water and minerals from a maximum amount of soil. Shallow roots are conducive to rapid fluctuations in grass health and irrigation mishaps. A long hot weekend without water may cause the lawn to die if the root system is shallow.

Excessive use of fertilizer and water will result in the need for more frequent mowing, without benefit to the lawn. Lawn clippings may be left on the lawn unless excessively heavy.

#### **E.07.3            Mowing Equipment for Lawns**

Power lawn mowers, prior to use, should be completely:

- (A) Lubricated
- (B) Adjusted
- (C) Checked for loose nuts and bolts

Oil level and gasoline supply should also be checked. Cooling systems should be checked twice daily for grass, which may be packed between the cooling fans and a cover.

The oil bath in air filters should be kept clean and free from grit, which could be sucked into the motor.

Height of cut may be adjusted by running the mower onto a level surface, placing a board under each reel as it is adjusted. Reels should never be tightened enough to cause any resistance against the bed knife.

#### **E.07.4            Irrigating Lawns**

Water requirements of a lawn depend upon the season, climate, soil, varieties of grasses, drainage, slope, slope aspect, and winds.

A deep-rooted system is developed by deep watering and helps lawns survive during periods of unusual climatic conditions.

Sprinklers should be allowed to run until the water has penetrated the soil well below the root zone. It may be necessary, due to quick run-off on a steep, dry slope or compacted soil, to start penetration by short and frequent watering until the soil is capable of taking a full watering. This method, however, should not be made a steady practice, as deep and less frequent watering is more beneficial.

#### **E.07.5            Fertilizing Lawns**

Chemical fertilizers are formulated for specific purposes, with the analysis required by law to be printed on the bag or container. An 11-8-4 (N-P-K) fertilizer would have an analysis of 11 percent nitrogen (N), 8 percent phosphorus (P) and 4 percent potassium (K). Of 100 pounds of an 11-8-4 formulation, eleven pounds would be actual nitrogen.

For best results under most highway conditions, a mixed lawn should receive one (1) pound of actual nitrogen per 1,000 square feet for each growing month. Correct amounts of fertilizers reduce the chance of "fertilizer burn", and maintain a constant rate of lawn growth rather than cycles of growth.

Lawns should never be fertilized while the grass is wet. Sufficient water should be applied after the fertilizer application to dissolve the fertilizer deeply into the root zone. This first watering must be thorough.

Fertilizers should be applied evenly with seeder-type spreaders or wheel-mounted fertilizer spreaders. Care should be taken with either type of spreader to place the fertilized strips to completely cover the area. Do not fill spreaders on the lawn as fertilizer is frequently spilled, killing the lawn in that area. Wheel-mounted spreaders will deposit excessive amounts of fertilizer on turns or while standing, unless the supply is shut off from the hopper.

#### **E.07.6           Controlling Weeds in Lawns**

Weeds in lawns can be controlled largely by proper turf management. A thick vigorous lawn leaves little room for weeds to grow. If the correct mixture has been planted for any given area, proper fertilizing, watering, mowing and drainage will control and prevent most weeds. Annual weeds may be controlled early in the growing season by fertilizing the lawn, raising the reels on the lawn mower until the crowns of the weeds have grown high enough to cut off, then lowering the reels and mowing.

Broadleaf perennial weeds (such as plantain and dandelion) often crowd into lawns on poor soil. Herbicide application may be used for broadleaf weed control. Equipment used for the application of broadleaf herbicides should be thoroughly washed inside and out with a neutralizer before being used for any spray materials, which will be applied to desirable plants. The neutralizing solution should remain in the tank overnight or longer. Contact the Landscape Specialist for a pesticide recommendation.

#### **E.07.7           Controlling Crabgrass in Lawns**

The key to a successful chemical crabgrass control program is knowing when crabgrass seeds germinate in a specific area and applying pre-emergent chemicals before they sprout.

Pre-emergent herbicides give the best control by killing plants prior to germination rather than allowing invasions to weaken the lawn from competition.

If crabgrass plants have developed, seed heads can be prevented from maturing by mowing and chemically treating with a registered post-emergent material.

The District Landscape Specialist must provide the pesticide recommendation.

**E.07.8          Lawn Soils**

Most lawns prefer a well-drained friable soil mixture of loam, sand, and humus content with a neutral (pH 7). Air is a vital necessity in the soil to encourage bacterial action on fertilizers decaying humus for the roots, and to aid movement of soil water.

**E.07.9          Renovating Lawns**

After years of mowing, a thick layer of thatch and humus can build up. This is especially true of Bermuda grass and crabgrass. Traffic will also deposit fine particles of soil and sand and trash on lawns adjacent to the traveled way to a depth well above the original lawn level. Renovation is necessary to correct these conditions.

Renovating should not be done on turf that has not built up thatch or silt, and should not be planned as a part of regular annual turf maintenance.

Once turf has been reduced to the desired level by renovation, this level may be maintained by the periodic use of a vertical-cut type mower. Without damage to the turf or unsightliness, this type of machine eliminates the horizontal runners of Bermuda and crabgrass, and lifts up the impermeable thatch.

Renovating should be done just prior to the growing season. This prevents a long unsightly recovery period, and reduces the possibility of a crop of weeds growing before the lawn becomes reestablished.

In areas of poor soil, a top dressing of weed and seed-free compost may be necessary to replace the humus which has been removed. Reseeding will be required in areas where the turf has been completely removed, but should not be considered in areas of Bermuda grass.

**E.07.10        Repairing Lawns**

In areas requiring repair or replacement of lawn, replant with the same sod, stolons, or seed mixture as used in the original planting.

In situations where the original planting has failed to thrive, the District Landscape Architect and District Landscape Specialist should be contacted for assistance in selecting a more suitable turf species. One (1) pound of most lawn seed mixtures is required for each 200 square feet of area.

If toxic materials have been spilled on established lawn areas, it is important to remove the soil to a depth including all the toxic material, replace with topsoil, and replant or cover with established sod. For a conspicuous area, repair may be made with sod from a less conspicuous area, or sod from the border around maturing shrub beds.

**E.07.11      Repairing Lawns with Sod**

In preparing an area to replace with sod, the existing lawn should be removed and the surface should be lightly cultivated after it has been firmed and leveled. Small or sunken areas should be repaired and re-leveled prior to sod installation. After laying new sod firmly onto the existing soil, the sod should be tamped or rolled with a weight to make contact with the soil, top dressed to fill cracks, and irrigated thoroughly.

**E.08      Lawn Diseases**

Lawn diseases are caused by fungi, bacteria, viruses, and nematodes.

In addition to the organic plant diseases, there are physiological diseases caused by unfavorable growing conditions, such as waterlogging, compaction, and chemical and fertilizer injury. Generally, serious disease injury is less likely to occur with vigorously growing grasses. Heavy organic content (thatch) on the surface is conducive to fungi.

**E.08.1      Controlling Sod Webworm in Lawn**

The Sod Webworm is probably the most troublesome insect in our lawns. Webworms hatch first in April and May, laying the eggs for another brood which hatches in August and September. The larva or web worms feed at night on the grass just above the ground and not on the roots.

For this reason, spray materials should be applied on a previously well-watered lawn area. Water should be withheld as long as possible after the spray application to retain the spray on the foliage. The District Landscape Specialist must be contacted for a Pesticide Recommendation. No treatment is required after cool weather starts since worm activity ceases. New lawns should normally be sprayed in May and June if Sod Webworms are present.

**E.08.2      Controlling Mites in Lawns**

Mites can be a serious problem on hybrid Bermuda grass in safety roadside rest areas.

Damage is evident as a wilted appearance due to mites sucking plant juice from the above-ground growth. Lawns are weakened and may die if not treated. Where damage is severe, the sparse areas will allow invasions of undesirable weeds to compete with the weakened Bermuda grass. The District Landscape Specialist should be contacted for a Pesticide Recommendation.

**E.08.3          Controlling Lawn Moth in Lawns**

Lawns sometimes get a lawn moth infestation. A heavy infestation of lawn moths may seriously degrade lawns. If you have an infestation, contact your District Landscape Specialist for an Insecticide Recommendation.

Lawn should be mowed and watered thoroughly, immediately prior to applying the insecticide. Do not water after application until necessary. The lawn should be left unmowed as long as practical after spraying.

**E.08.4          Controlling Brown Patch in Lawns**

Brown Patch is caused by a fungus which develops during periods of high temperature and humidity. It appears as regularly shaped, browned area from a few inches to 3 feet or more in diameter. This condition is recognized by the dead grass attached to its roots, in contrast to the loose dead grass on an area killed by the sod Webworm. Brown Patch usually prefers bluegrass, rye grass, and bent grass lawns.

Good turf management is the best IVM method cultural to prevent Brown Patch from occurring.

Infected areas should be mowed 2 inches high, watered deeply, not more often than twice a week, and not over-fertilized.

If Brown Patch exists, repeated applications of fungicides may be necessary. Contact your District Landscape Specialist for a Fungicide Recommendation.

**E.09          Washing Plantings**

In the event landscape plantings along freeways become unhealthy due to deposits of road dust and exhaust residues on the foliage, plant health may be restored and maintained by periodic washing.

Clean water is sufficient, however a small amount of wetting agent or plant soap in the water may be required under extreme circumstances to loosen the encrustation. Minimize and control runoff into drainage pathways and waterways.

## E.10 Pruning

Pruning preserves the health and structure of trees and shrubs, prevents damage to adjacent property, and provides safety for vehicle, bicycle, and pedestrian traffic.

Tree pruning practices will follow the current ANSI A-300 standards.

Trees or shrubs should be trimmed to ensure visibility of highway signs and safety devices. Pruning should also provide a 17 foot clearance above the traveled way and shoulder.

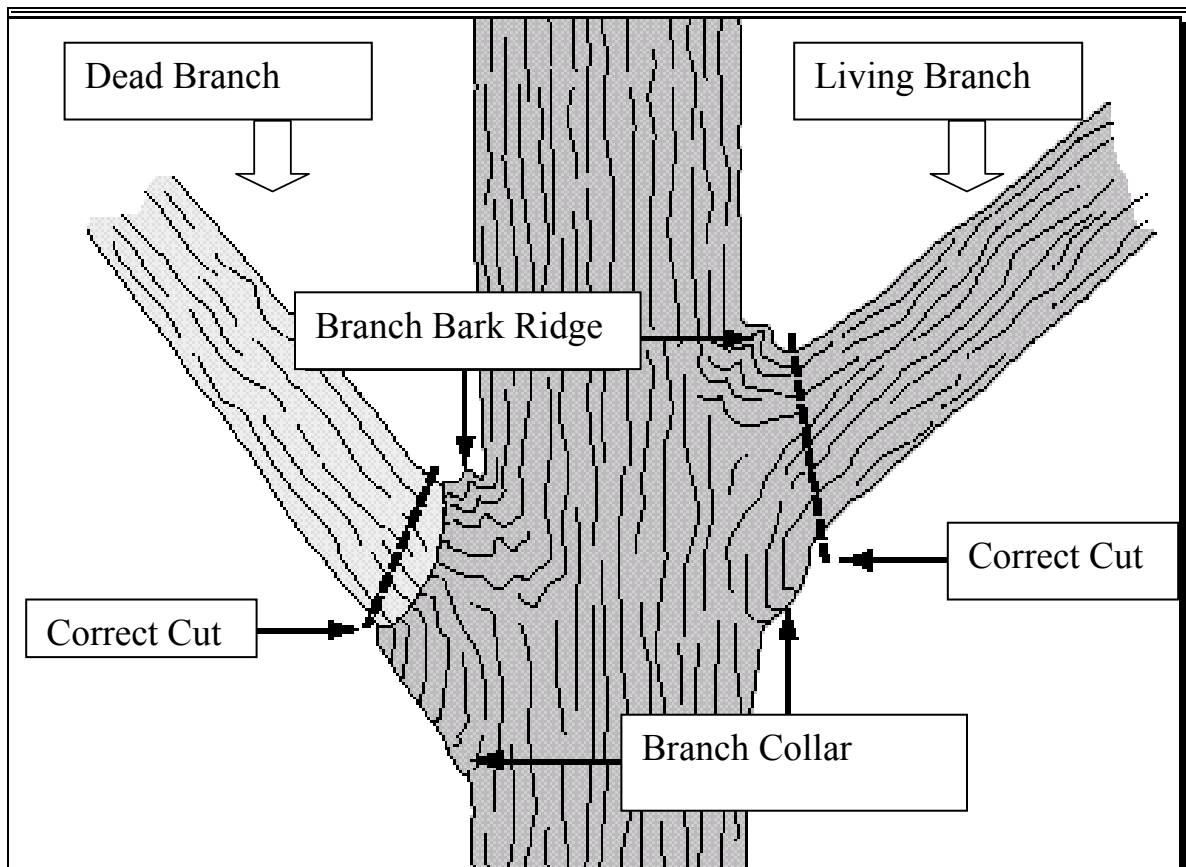


Figure E-1: Pruning

Target tree cuts just outside the branch collar and branch bark ridge. This is the area where trees can isolate wounds and heal quickly. Cuts farther away from the target area encourage rot and disease in trees.

### **E.10.1          Pruning Trees**

Newly planted trees should not be pruned except to remove broken or damaged limbs. After the tree has begun to establish its root system and new growth becomes visible, light pruning for shape can begin. Proper pruning of young established trees can save the tree from severe pruning and many hours of the tree crews' time when the tree matures. Lower limbs should not be removed.

New growth can be encouraged in older plants by periodically removing large, old inner wood to open up the interior of a plant. Some plant species, such as Acacias, when used as a group or screen planting, may need topping while young to force lateral (side) spreading.

Plants that tend to be leggy or have excessive top growth may be topped by cutting the taller shoots back to lower outside lateral shoots or branches.

All young trees should be left with a form characteristic of their species following pruning.

### **E10.2          Pruning Deciduous Ornamental Trees**

Pruning deciduous ornamental trees is different than pruning massed shrubs (either in a lineal pattern or in a large mass-grouped area). Individual deciduous tree pruning should be confined to the removal of suckers and crossing branches. Low limbs should be encouraged, not removed. Lateral limbs must be shortened or removed if they interfere with traffic and other safety issues. The terminal of the leader can be cut back to an upright lateral only if a serious bend has occurred due to a prevailing wind.

A strong, straight leader should not be cut back in order to force low lateral growth. Such a tree will assume its own characteristic proportions if untouched; therefore, pruning is best confined to corrective cuts necessitated by wind, suckers, or breakage. The majority of pruning, and especially heavy trimming, on deciduous trees should only be done during dormancy.

### **E10.3          Pruning Evergreen Ornamental Trees**

Evergreens are never completely dormant. They often have several flushes of growth each year. They may be pruned anytime, except when flowers or fruit are desired. Such trees should be pruned, if required, after their showy period.

As with deciduous ornamental trees, pruning on evergreen ornamentals should be minimal, only to remove crossing branches. Lower branches of young pyramidal evergreen trees should not be removed.

#### **E10.4            Pruning Shrubs**

Pruning reduces the size of a shrub without altering its natural appearance. Pruning removes dead and diseased limbs, crossing limbs, and reduces the size of overgrown shrubs. Pruning also promotes or directs new growth, blossoms, fruit, and/or berries.

The best practice is to prune most shrubs and trees during the winter season, while plants are dormant. Where lateral (side) branching in mass-planted shrubs is desired, tops of apical (top) branches of young plants should be pruned back to a suitable level to encourage lateral (side) branching.

#### **E10.5            Pruning in the Median**

Prune if growth encroaches onto the shoulder. Oleanders within a median or screen planting should not be regarded as individual plants. Any pruning should treat them as a unit or mass.

Low branching and ground coverage should be encouraged. Low growth should not be removed. These same methods should be applied to other shrubs also used for median or screen plantings.

#### **E10.6            Pruning Tools**

Proper tool usage and correct pruning techniques are very important. Caltrans uses a wide variety of pruning tools including chainsaws, pole loppers, saws, bow saws, ratcheting (forestry) loppers, hand shears, and loppers. Always select the best tool for the plant being pruned.

Hedge shears should not be used to prune shrubs except for retaining hedges and shrubs designed to be maintained in a formal manner. Hedge-shear type of clipping results in a hedge or shrub having such dense growth on the perimeter that the inside of the plant is bare of foliage from the lack of light.

In general, the use of tractor-mounted mower heads should not be used to trim shrubs (oleanders, etc.), as they do not make smooth cuts and they tend to tear. Orchard cutter heads that make smooth cuts are acceptable in some situations. Tractor-mounted mowers should not be used to prune trees or large shrubs at any time.

## E.11 Weed Control

Caltrans utilizes Integrated Vegetation Management (IVM) methods for weed control for E family landscapes. There are seven general IVM methods including:

- Mechanical
- Manual
- Cultural
- Biological
- Chemical
- Thermal
- Structural

IVM is an environmentally sound system that uses all available knowledge, methods and tools to provide a long-term management strategy. This strategy minimizes losses caused by weeds and pests, with as little cost as possible, and minimal disruption of the environment.

### E.11.1 Mechanical

Mechanical method of weed control is mowing with a tractor-powered mower. (Hand-held power equipment such as weed-eaters and walk-behind mowers are a manual weed control method).

While there is limited use for a highway mower in a fully landscaped area, it is still a viable form of weed control. Highway mowers work best in plantings of occasional trees and shrubs (on bubbler irrigation) with large unplanted areas in-between.

Mowing may damage sensitive resources, native grasses, wildflowers and other plantings. Mowing height and timing are important. Refer to C2.11 of Maintenance Manual, Volume 1. Mowing can also spread noxious weeds. Consult with your District Landscape Specialist before you mow more than prescribed for your Maintenance area. Check your district's mowing plan in IMMS. Your District "Mowing Plan" may be viewed under "Assets" under VegCon Reports. Sensitive resources are also identified by the IMMS system at this same location.

### E.11.2 Manual

Manual methods of weed control consist of weed control by hand. Manual methods include hand pulling, hoeing, or using hand-held power tools (such as a chainsaw, weedeaters and walk-behind mowers). The manual methods are usually the most expensive, but may be the only way to control existing weeds in planting areas. When considering manual control, using special programs people will help reduce the costs. Special programs people perform most of Caltrans manual control with Caltrans Maintenance personnel providing supervision and support.

**E.11.3 Cultural**

Cultural methods of Vegetation Management include a wide variety of general horticultural practices that promotes healthy plantings and discourage unwanted vegetation (weeds).

Selection of the right plant for the right place helps Caltrans achieve effective vegetation management in our landscapes. When selecting replacement plants, the plant species may be changed to another plant species if the original plant species had problems. Plant species changes must be approved. Contact your District Landscape Specialist before changing plant species.

Attention to irrigation timing, coverage and quantity encourages the growth of desirable plants and discourages the growth of weeds. Too much water stunts the growth of drought-tolerant plants and encourages undesirable water-loving weeds. Some of the hardiest plants we use, especially in Southern California, don't need regular watering in the arid months. You may need to consult with your District Landscape Specialist or District Landscape Architect to determine the appropriate irrigation schedule for plants in your area. Overhead spray heads irrigating unplanted ground wastes water and encourages weed growth.

Mulching applications at the recommended thickness will either suppress, reduce, or eliminate the growth of unwanted vegetation such as weeds. Mulch helps reduce Caltrans' dependence on herbicides. Mulching also serves as a moisture retention agent by insulating the soil from sun, heat, and winds, which accelerates the evaporation process.

Proper fertilizing practices will promote healthy root and foliage growth that will aid in the vegetation's ability to withstand adverse conditions. Poor fertilizing practices may lead to poor plant health and opportunity for weeds to establish.

Recommended pruning practices will enable a stronger root system, healthier foliage growth, and help withstand plant stress from extreme events such as high winds, soil contamination, or vehicle impacts.

Refer to Section E.10.

#### E.11.4 Biological

Biological control is the use of natural enemies to reduce a plant's pest population to the level at which it is no longer an economic problem. Most biological control organisms are predators, parasites and pathogens. Classical biological control involves the deliberate introduction and establishment of exotic natural enemies into areas where they did not previously occur. Biological control (as an IVM method) typically is slow acting, safe for human health and the environment, and low cost (very economical). In order for biological control to work effectively, some population of the pest must remain in order to provide habitat for the natural enemy. Biological control is not appropriate for immediate control, since it may take up to ten years to succeed.

#### E.11.5 Chemical

The chemical material should be chosen for effective use according to the needs of the job, the weather, the soil, and the characteristics of the herbicide.

Contact herbicides such as Reward, Pelargonic acid, and others, are effective in killing the tops of existing weeds. They often are desirable where chemical residue from other herbicides might contaminate soil or hurt the roots of nearby trees or shrubs. Contact herbicides may "knock-down" the tops of deep-rooted perennial weeds even though the roots are not permanently injured or killed. They are of special value for controlling annual weeds.

In general, except for Reward, contact weed killers are most effective when applied on warm, sunny days and are less effective in cold weather. Wet the plant thoroughly for a good kill. Runoff on the soil is ineffective, increases costs, and should be avoided

Pre-emergent herbicides will prevent seeding weed growth when applied on clean ground. They are dependent on being moved into the soil by either irrigation or rainfall. They may be selective of the plants they kill and may be chosen to kill weeds with no injury to intermingled ornamental shrubs by careful adjustment of rate of use. Some pre-emergents, when used at safe rates in highway plantings, have a short residual effect after contact with the soil, whereas others allow a greater effective time between application and rainfall or germination of the seeds.

At certain rates, some pre-emergents (such as Surflan) may be used in highway plantings. Other pre-emergent materials include Ronstar, Casoron, and various other formulations. These herbicides can be either selective or non-selective.

Translocating or systemic herbicides function by absorption into the leaf, stem, or root system and subsequent translocation to all parts of the plant. Some systemic herbicides are designed for spray application to the aerial plant parts, while others are designed to be applied to the soil as a pre-emergent. They may be selective or they may be non-selective, such as with glyphosate (Roundup), killing or damaging any plant material the herbicide touches.

Foliar application of systemic herbicides must be made during the active growing season when they will translocate throughout the plants. Root applications must be available to the plants when the plants are actively growing. Most systemic herbicides applied foriarly are absorbed with 24 hours after application, although the kill may not become apparent for a week or more. These herbicides can be either selective or non-selective.

Growth retardants or inhibitors are intended to physically change plants by reducing the growth rate. Growth of shrubs, trees, groundcovers, etc., can be effectively controlled by use of these chemicals, thereby extending the periods between pruning, edging, or mowing.

Results depend on many factors such as plant material, location, weather conditions, and time of year. Label information of various products must be consulted prior to use. The materials should be tried experimentally before general use. The District Landscape Specialist will coordinate this for your operation.

Refer to C2.26 of Maintenance Manual, Volume 1 for a thorough discussion of herbicides.

#### **E.11.6 Thermal**

Thermal control is the use of fire or heat as a vegetation management tool. Thermal is not a preferred IVM method for established landscape plantings.

The use of prescribed burning for land management is a controversial topic. Permits and fire plans are required. How and when and whether to burn varies by vegetation type, target weed species, region, topography, management history, annual climatic variations, season, and weather (which itself can vary throughout the day). Thermal methods are best for rural areas with heavy weed infestations, and for re-establishment of native plants.

#### **E.11.7 Structural**

Structural control is the use of “hard materials” to reduce the amount of vegetative areas. Commonly known as hardscaping, structural control works best for areas closest to the roadway, or in areas with high safety concerns. There are both permeable and non-permeable hardscaping materials. Hardscaping has many different patterns, colors, and textures to choose from. Hardscaping choices include fiber weed control mats, polyureas, rubber weed control mats, rock cobble, rock blanket (mortared cobble), rock slope protection, stamped asphalt, and patterned concrete.

Structural control is the best way to meet Caltrans’ herbicide reduction goal of 80% by 2012. Request structural controls during design or rehabilitation projects, since this is the appropriate method for hardscape installation. Consult your District Landscape Architect. Areas to consider for structural control include medians, gore points, maintenance vehicle pullouts, slope paving, narrow areas, guardrails, signs, and other designs for safety items.

#### **E.11.8 Toxicity of Landscape Chemicals**

Chemical pesticides such as herbicides, insecticides, fungicides, and rodenticides are tools used in Caltrans Landscape maintenance operations.

Hundreds of products are registered and sold in California to control pests. The hazards involved in pesticides must be understood and respected by those who purchase and use them.

Federal and State laws regulating the many operations involving the purchase, storage, and use of pesticides change too frequently for inclusion in this manual.

The California Department of Pesticide Regulations (DPR) frequently publishes regulations to reflect changes. Copies of changes are available at DPR headquarters in Sacramento or from your Local County Agricultural Commissioner. It is imperative that each applicator, and others responsible for pesticide use, be aware of and comply with regulations as they become effective. A copy of a Pesticide Recommendation must be in possession of the chemical applicators.

Refer to C2.22 of Maintenance Manual, Volume 1 for a thorough discussion of pesticide toxicity.

#### **E.12 Rodent Control**

Effective rodent control depends on a thorough knowledge of rodents and rodenticides. Rodents' eating habits, burrowing patterns, and peculiarities require a wide knowledge of the rodents being controlled.

Chemicals used to control rodents are normally highly toxic materials. Even though they are used in a diluted form, they are difficult to use correctly and dangerous to handle.

Rodent control is best accomplished through a cooperative agreement or a service contract. Some County Agriculture Commissioners are willing and are staffed to do rodent control work through a cooperative agreement. Caltrans pays for the bait and labor.

Caltrans only use anti-coagulant rodenticides. Many County Agricultural Commissioners sell anti-coagulant rodent bait at their offices.

Under no circumstances will the rodenticide Compound 1080 (Sodium Monofluoroacetate) be used on State highways.

Class 1 and restricted materials should be avoided. Contact your District Landscape Specialist for a Rodenticide Recommendation.

**APPENDIX E-A**

**GLOSSARY OF PLANT AND PRUNING TERMS**

ACCESSORY BUD:	extra buds in the leaf axil.
ADVENTITIOUS BUD:	any bud arising anywhere except in the leaf axils.
ALTERNATE:	leaf or bud arrangement where there is only one leaf or bud at a node.
ANNUAL:	a plant completing a life cycle in a year and then dies.
ANTHER:	male or pollen bearing portion of stamen.
ASEXUAL:	reproduction by means of cuttings, leaves, roots, root divisions.
ASSIMILATION:	transforming digested nutrients into protoplasm.
AXILLARY BUD:	bud in axil of a leaf.
BALLED:	plant transplanted with roots in a ball of earth.
BARE ROOT:	plant transplanted with no soil on the roots.
BERRY:	simple fleshy fruit, the ovary wall fleshy and including one or more carpels and seeds.
BIENNIAL:	plant that completes its life cycle within two years and then dies.
BOTANY:	science dealing with plant life.
BRANCH AXIL:	the angle formed where a branch joins another branch or stem of a woody plant.
BRANCH BARK RIDGE:	a ridge of bark that forms in the branch crotch that marks where the branch wood and trunk wood meet.
BRANCH COLLAR:	trunk tissue (a shoulder or bulge) that forms around the base of a branch or lateral between the main stem and the branch or a branch and a lateral.

BROADLEAF:	pinnate or palmate veins as contrasted to parallel veination of grasses.
BULB:	short, flattened, or disc-shaped underground stem, with many fleshy scale leaves filled with stored food.
CALLUS:	mass of large cells (tissue) that is formed by the cambium layer around a wound.
CALYX:	outside flower whorl.
CAMBIUM LAYER:	growth tissue just under the bark.
CAPSULE:	dry, dehiscent fruit with two or more carpels.
CARPEL:	a floral leaf bearing ovules.
CHLOROPHYLL:	green coloring matter in cells.
COMPLETE FLOWER:	flower having the usual flower parts (petals, sepals, stamens, pistils, and carpels).
COMPOUND LEAF:	leaf made up of a number of separate parts.
CONIFER:	cone-bearing evergreen.
CORM:	short, solid, enlarged underground stem containing stored food.
COROLLA:	petals, usually the colored part of a flower.
CROWN:	the leaves and branches of a tree or shrub; the upper portion of a tree from the lowest branch on the trunk to the top.
CROWN CLEANING:	the removal of dead, dying, crowded, weakly attached, low-vigor branches and water sprouts from the tree's crown.
CROWN RAISING:	the removal of lower branches of a tree (skirting) to provide clearance for pedestrian, vehicles or to improve sight distance; at least one-half of the foliage should be on branches originating on the lower two-thirds of the trunk.

CROWN THINNING:	the selective removal of branches to increase light penetration and air movement, reduce wind resistance and weight; do not remove more than one-quarter of the living crown of a tree in a growing season.
CROWN REDUCTION:	reduction of the height or width of the crown by thinning to interior lateral branches; laterals should be at least one-third the diameter of the limb being removed; no more than one quarter of the leaf surface should be removed in a growing season.
COTYLEDON:	seed-leaf of a plant.
CUTICLE:	waxy layer on outer wall of epidermal cells.
CUTIN:	waxy substance very impermeable to water.
CUTTING:	a section of stem, root, or leaf, used for asexual reproduction of plants.
DECURRENT:	a major tree form resulting from weak apical control; trees with this form have several lateral branches that compete with the central stem for dominance resulting in a spherical round crown; most hardwood trees have a rounded crown; oak and ash trees are decurrent in form.
DECIDUOUS:	trees or shrubs that lose their leaves each fall.
DICOTYLEDON:	plant whose embryo has two leaves cotyledonsbean.
DIOECIOUS:	male and female blooms on different individual plants (English Holly).
EGG:	female part of the flower contained in the ovary, which becomes the seed after fertilization and development.
ENZYME:	organic catalyst that is able to alter the rate of a chemical reaction.
EPIDERMIS:	outside layer of cells.
EVERGREEN:	a plant that retains old leaves until new ones have fully developed.

EXCURRENT:	a major tree form resulting from strong apical control; trees with this form have a strong central stem and pyramidal shape; lateral branches rarely compete for dominance; most conifers and a few hardwoods, such as liquidamber and tulip trees have excurrent forms.
FILAMENT:	stalk of stamen bearing the anther at the tip.
FLORABUNDA:	producing many flowers.
FLOWER:	that part of a plant containing the reproductive organs.
FOLIAGE:	the leafy portion of a plant.
FRUIT:	product of a plant containing the seeds.
GENE:	substance in a chromosome that determines hereditary characteristics.
GERMINATE:	to sprout or start growing from a seed.
GRAFT:	fasten a scion to a stock, usually the scion being another species.
GRASS:	plants with parallel venation.
GROUND COVER:	shrub, vine or dense growing plants used to control erosion or weeds.
GROWTH REGULATOR:	chemical used to increase or decrease the rate of plant growth.
HEADING:	a poor maintenance practice used to control the size of trees; involves the indiscriminate cutting to stubs, shoots, buds or branches not sufficiently large enough to assume the terminal role; synonyms terms include round-over, heading back, dehorning, topping and hat-racking.
HEDGE:	compact group of plants usually used as a screen or windbreak--may or may not be formally trimmed.
HEEL IN:	cover roots with soil, shavings, etc., and water in.
HEREDITY:	transmission of characteristics or qualities from parent to offspring.

HORMONE:	a substance capable of influencing a specific physiological process even though present in minute quantities.
HUMIDITY:	amount of moisture in the air.
IMPERFECT FLOWER:	flower lacking either pistils or stamens.
INCOMPLETE FLOWER:	a flower lacking one or more of the four kinds of flower parts (calla lily).
INCLUDED BARK:	bark that is embedded between opposing branches and a main stem or two co-dominant stems creating a structurally weak point in the tree or shrub.
INFLORESCENCE:	a flower cluster.
INTERNODE:	region of stem between two successive nodes.
LATERAL:	a branch or twig growing from a parent branch or twig.
LATERAL BUD:	bud which grows out from the side of the stem.
LEAF:	thin flat part of a plant used chiefly to manufacture plant food.
LEAF AXIL:	angle formed by the leaf stalk and the stem.
LEAFLET:	separate part of the blade of a compound leaf.
LEGUME:	a two-valved seed pod, splitting along both edges when dry, as a pea or bean pod.
MONOCOTYLEDON:	plant whose embryo has one cotyledon.
MONOECIOUS:	stamens and pistils in separate flowers but borne on the same plant.
MUTATION:	deviation from parent characteristics not attributed to heredity.
NODE:	that portion of the stem where leaves and buds arise and where branches originate.
NUCLEUS:	a central mass around which matter grows.
NUTRIENT:	material that nourishes and promotes growth.

OPPOSITE:	bud or leaf arrangement in which there are two buds or two leaves at a node.
OSMOSIS:	passing of a dilute solution through a semi-permeable membrane into a more concentrated solution.
OVARY:	enlarged basal portion of the pistil that becomes the fruit.
PALMATELY VEINED:	leaf blade with several principal veins spreading out from the upper end of the petiole (maple, plane).
PARALLEL VEINED:	leaf blade in which veins are parallel to each other.
PARASITE:	organism deriving its food from the living body of another plant or animal.
PEDICEL:	individual stem of flower of an inflorescence.
PERENNIAL:	plants continuing to grow more than two years.
PERFECT FLOWER:	flower having both stamens and pistils.
PERIANTH:	petals and sepals taken together.
PETAL:	usually the conspicuous colored part of the flower.
PETIOLE:	stalk of leaf.
PHOTOSYNTHESIS:	carbon dioxide and water united chemically to form carbohydrates with the energy being furnished for the process by light.
PINNATELY VEINED:	leaf blade with a single midrib from which smaller veins branch off (elm).
PISTIL:	central organ of the flowers typically consisting of stigma, style and ovary.
PISTILLATE FLOWER:	flower having pistils but no stamens.
POLLINATION:	conveying pollen from the anther to the stigma.
RECEPTACLE:	enlarged end of the pedicel to which other flower parts are attached.

RENOVATE:	remove matted portion from the top layer of turf or lawn.
RHIZOME:	elongated underground, horizontal stem.
ROOT:	part of the plant that descends and fixes itself in the earth to anchor and nourish the rest of the plant.
RUNNER	stem growing horizontally along the ground surface.
SCION:	that part grafted onto the stock.
SEED:	part of a plant containing the embryo and stored food for a future plant.
SEPALS:	outside flower parts that usually enclose the other flower parts in the bud.
SESSILE:	leaf with no petiole.
SHEATH:	part of a leaf that wraps around the stem, as in grasses.
SHRUB:	a multiple stemmed woody plant smaller than a tree.
STAMEN:	male or pollen-bearing flower part consisting of an anther and filament.
STAMINATE FLOWER:	one having stamens but no pistils (begonia).
STIGMA:	sticky expanded end of the pistil to which pollen adheres.
STIPULE:	leaf-like structures growing from either side of the leaf base.
STOLON:	same as runner-horizontal stem growing above the surface of the ground.
STUNT:	suppressed growth.
STYLE:	threadlike tissue connecting the stigma and ovary and through which the pollen tube grows.
SYSTEMIC:	passing through the plant system.
TAXONOMY:	science dealing with naming, describing and classifying plants.
TENDRIL:	twining part of a plant that attaches itself to a supporting body.

TERMINAL BUD:	a bud at the end of a stem.
TISSUE:	cells of similar structure that perform a special function.
TOXIC:	poisonous.
TRANSLOCATE:	move from one part of a plant to another, usually from the leaves to the roots.
TRACING:	shaping a wound by removing loose bark from in and around a wound.
TREE:	woody plant having a single stem and branches.
TUBER:	short, fleshy, underground stem (potato).
TURF:	lawn grasses, sod.
TURGOR:	pressure within the cell resulting from absorbed water.
VEGETATION:	plant growth.
VEINATION:	vein arrangement in leaf blade.
VINE:	a slender climbing plant.
WEED:	any plant growing uncultivated or noxious to cultivated crops; a plant growing in an unwanted location. The term “noxious weed” refers to a weed that is listed on the California Department of Food and Agriculture noxious list. The noxious weed list and rating system (A, B and C) is determined by the amount of monetary damage, or potential damage, to crops and livestock and the magnitude of weeds distribution.
WEED TREES:	unplanted trees, typically considered a very big weed.
WHORL:	a circle of leaves or flower parts.
WILT:	to droop or lose freshness.

# **CHAPTER F**

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Original signed by  
Sheree Edwards  
Office of Roadside  
Division of Maintenance

**F.00 Introduction**

The Headquarters Division of Maintenance and District Maintenance Divisions (referred to herein as Maintenance) are responsible for the care and upkeep of State highways. Maintenance performs activities that may impact storm water and receiving water quality. On July 15, 1999, the Department received a National Pollutant Discharge Elimination System (NPDES) four-year permit regulating storm water discharges from properties, facilities and activities. The permit required the Department to implement a Storm Water Management Plan (SWMP) to manage discharges and potential discharges to storm water drains. The Maintenance Storm Water Management Program is the component of the Statewide Storm Water Management Plan (SWMP) that:

- Defines and implements Maintenance Best Management Practices (BMPs) to ensure all Division of Maintenance facilities are in compliance with NPDES requirements;
- Defines and implements Maintenance Best Management Practices (BMPs) to ensure all Maintenance personnel activities on existing State highways and within the Department's right of way are in compliance with NPDES requirements;
- Manages potential storm water pollution from accidental spills, illicit connections, illegal discharges, and illegal dumping within the Department's right of way;
- Maintains structural Storm water BMPs; and
- Conducts periodic erosion inspection of State highway vegetated slopes.

It is the policy of this Department that the Division of Maintenance will:

- (A) Implement the Maintenance Storm Water Management Program described in the Statewide Storm Water Management Plan;
- (B) Implement the Best Management practices defined in the Caltrans Storm Water Quality Handbook Maintenance Staff Guide;
- (C) Follow all appropriate State, federal, and local laws and regulations regarding water quality including all court orders and consent decrees.
- (D) Meet all requirements of Regional Water Quality Control Board (RWQCB) and State Water Resources Control Board (SWRCB) permits and orders.

Maintenance will adapt its program to meet changes in law and to keep current as new technologies are developed.

## **F.01 Responsible Parties**

The Division of Maintenance is responsible for developing this chapter and for making revisions as needed.

In conjunction with the Division of Environmental Analysis, the Division of Maintenance is responsible for the Caltrans Storm Water Quality Handbook Maintenance Staff Guide (“Staff Guide”). The Staff Guide is the guidance document that provides detailed descriptions of Best Management Practices (BMPs) for NPDES permit and SWMP compliance in Maintenance activities, and instruction for implementation of these practices in the districts.

The Division of Maintenance is responsible for coordinating with the Division of Environmental Analysis, the designated lead for the Department’s Storm Water Management Plan storm water issues, to ensure that this chapter and other Maintenance Storm Water Management Program documents are not in conflict with overall Departmental policy.

The following persons are responsible for implementing the Division of Maintenance Storm Water Management Program policy:

The **Chief, Division of Maintenance**, is responsible for statewide implementation of policies and procedures, and the personnel and equipment of the Maintenance Division. This includes ensuring compliance with all elements of the Statewide SWMP required by the Maintenance Division

The **Headquarters Maintenance Storm Water Coordinator** is the liaison with Headquarters Environmental Division. The Coordinator provides guidance to District NPDES (or District Maintenance Storm Water) Coordinators regarding water quality issues. The Coordinator is responsible for overseeing development of storm water guidance documents used by Maintenance.

The Districts are responsible for implementing the SWMP within the district, and complying with the permit and any RWQCB-specific requirements.

The **Deputy District Directors, Maintenance** are responsible for the implementation of the policies, procedures, personnel and equipment of the Maintenance Storm Water Management Program within their respective districts. This includes ensuring compliance with all elements of the SWMP required to be implemented by the District Maintenance Divisions. The Deputy District Director, Maintenance provides direct supervision to the Maintenance Region Managers.

The **Maintenance Region Managers** direct Maintenance activities within regions or programs of a district. Each region is subdivided into Maintenance areas. The Maintenance Manager provides direct supervision to the Maintenance Area Superintendent within each region or program.

The **Maintenance Area Superintendents** direct Maintenance activities within Maintenance areas, and provide direction to Maintenance Supervisors. Maintenance areas contain multiple Maintenance facilities. The Superintendents are responsible for ensuring that Maintenance BMPs are implemented in their jurisdictions as follows:

- (1) Directing personnel or contractors to implement the Maintenance Storm Water Management Program;
- (2) Assuring that personnel under their supervision receive training on storm water management practices;
- (3) Evaluating the performance of personnel with respect to storm water management duties and responsibilities; and
- (4) Reviewing the implementation and effectiveness of the Maintenance Storm Water Management Program BMPs.

**Maintenance Supervisors** are responsible for direct supervision of a Maintenance crew. Supervisors provide on-the-job training for specific crew assignments, including compliance with water quality protection requirements. Supervisors have on-site responsibility for BMP implementation.

The **District NPDES Storm Water Coordinators** serve as liaison with the Water Quality Program. Liaison activities include conducting meetings related to Storm Water Management issues with the Coordinators from each functional unit, and with other MS4 permittees to discuss problems and concerns. Liaison activities also include regular communications with representatives of the RWQCB. The functional unit Coordinators will assist the district Divisions in implementing the Division's storm water management activities.

**District Maintenance Storm Water Coordinators** (also referred to as District Maintenance Storm Water Managers) are established in each district. Districts have designated Storm Water Coordinators, in other functional units such as, Environmental, Construction and Design.

District Maintenance Storm Water Coordinator responsibilities include:

- (1) Serving as the point of contact for regulatory inquiries regarding implementation of the Maintenance Storm Water Management Program;
- (2) Reviewing proposed storm water compliance programs for elements related to Maintenance activities;
- (3) Monitoring and evaluating BMPs implementation and effectiveness as related to Maintenance activities;
- (4) Participating in meetings related to storm water management issues with Storm Water Coordinators from other functional units in the district to discuss problems and concerns, and areas that need attention;
- (5) Coordinating with Headquarters Maintenance to arrange training of district Maintenance personnel in storm water quality management; and
- (6) Compiling and preparing materials for the Division of Maintenance portion of the Department's Statewide Storm Water Management Program Annual Report to the SWRCB.

The **District Hazardous Material Coordinators** (also referred to as a District Hazardous Material Managers) coordinate response to spills of hazardous substances on Caltrans right of way, and coordinates management of Caltrans-generated hazardous waste. The Coordinator is usually responsible for providing training information associated with hazardous materials, and may be responsible to assist in implementing storm water quality protection practices in the district.

The **District Landscape Specialists** provide guidance regarding use of pesticides and chemical control of vegetation in field Maintenance operations. The Landscape Specialist is responsible for ensuring that all chemicals used in the district are approved by the responsible regulatory agencies.

**Maintenance Leadworkers** conduct tailgate meetings (in absence of the Maintenance Supervisor) to review environmental concerns, BMPs, and ensures that appropriate procedures are implemented during Maintenance activities.

**Maintenance Workers/Landscape Workers/Equipment Operators** are responsible for implementing BMPs while conducting Maintenance activities.

The **District Equipment Managers** ensures that vehicle inspections include checks for leaks on district Maintenance vehicles.

The **Equipment Shop Superintendents** are the front line managers who direct vehicle servicing and repair activities within an equipment shop or service region.

**Mechanics** (resident/traveling) are responsible for implementing BMPs while conducting vehicle servicing and repair activities.

## **F.02 Background and Legal Requirements**

Federal regulations for controlling discharges of pollutants from municipal separate storm sewer systems (MS4s), construction sites, and industrial activities were incorporated into the National Pollutant Discharge Elimination System (NPDES) permit process by the 1987 amendments to the Federal Water Pollution Control Act (also referred to as the Clean Water Act [CWA]), and the federal storm water regulations issued by the U.S. Environmental Protection Agency (EPA) in 1990. The federal storm water regulations require municipal, construction and industrial storm water discharges to comply with an NPDES permit.

In California, the EPA delegated NPDES permitting authority to the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs).

Under federal regulations, aspects of Caltrans facilities and highway systems are under the jurisdiction of NPDES storm water regulations for two primary reasons:

- (1) Highways and related facilities are served by extensive storm water drainage systems that in urban areas are often connected to, and are considered to be comparable to, municipal storm drain systems, which are covered explicitly in the regulations.
- (2) Construction of highways and related facilities often results in soil disturbance for which specific requirements are contained in the federal regulations and the State's General Permit for Storm Water Discharges Associated with Construction Activity.

To achieve a consistent approach to compliance with the storm water regulations, Caltrans determined that a statewide permit would be the most effective approach to address its activities in all districts, and worked with the State Water Resources Control Board (SWRCB) to achieve one.

The SWRCB issued an NPDES Statewide Storm Water Permit (Permit) to Caltrans in 1999 (Order No. 99-06-DWQ [NPDES No. CAS000003]) to regulate storm water discharges from Caltrans facilities. The permit regulates storm water discharges from Caltrans' rights of way both during and after construction, as well as from existing facilities and operations. The permit also gave the RWQCBs the option to specify additional requirements considered necessary to meet water quality standards. A copy of the Caltrans NPDES Statewide Storm Water Permit can be downloaded from the Caltrans Storm Water Management Program web site (<http://www.dot.ca.gov/hq/env/stormwater/special/index.htm>), or requested from the Headquarters Maintenance Storm Water Coordinator.

Discharges from Caltrans' right of way that are not composed entirely of storm water are prohibited. Therefore, appropriate BMPs must be installed to remove pollutants to the Maximum Extent Practicable (MEP). The permit language is "Any discharge from Caltrans right of way or Caltrans properties, facilities, and activities within those rights of way that is not composed entirely of 'storm water' to waters of the United States is prohibited unless authorized pursuant to...this NPDES Permit (General Discharge Prohibitions, A.1)."

The permit directs Caltrans to implement and maintain an effective Storm Water Management Plan (SWMP) to reduce the discharge of pollutants to storm water drainage systems that serve highways and highway-related properties, facilities and activities. The Caltrans Statewide SWMP is the Caltrans policy document that describes how Caltrans conducts its Storm Water Management activities (i.e., procedures and practices), provides descriptions of each of the major management program elements, discusses the processes used to evaluate and select appropriate BMPs, and presents key implementation responsibilities and schedules. The Maintenance Storm Water Management Program is a component of the Statewide SWMP, and is described in Section 5 of the SWMP. The permit requires Caltrans to implement a year-round program in all parts of the State to effectively control storm water and non-storm water discharges. To meet permit storm water discharge requirements, Caltrans has implemented four general categories of BMPs including the approved Maintenance BMPs. These approved Maintenance BMPs are described in the Caltrans Storm Water Quality Handbook Maintenance Staff Guide.

**F.03 Caltrans Storm Water Quality Handbook – Maintenance Staff Guide**

The Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (Staff Guide) is the key document in the Maintenance effort to protect water resources. That document provides detailed instructions for incorporating Best Management Practices (BMPs) in maintenance activities.

The key components of the Staff Guide are:

- (A) Objectives of Maintenance Storm Water Management Program.
- (B) Pollutants of Concern for Highway Maintenance Activities and Facilities.
- (C) Incorporation of Storm Water Controls into Maintenance Programs and Activities.
- (D) Program Evaluation.
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# CHAPTER G

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Original signed by  
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## **G.00 Introduction**

This chapter discusses maintenance of public facilities. Public facilities include the following:

- (A) Safety Roadside Rest Areas (SRRA).
- (B) Weigh Stations.
- (C) Park and Ride Lots.
- (D) Vista Points.

Agricultural Inspection stations are not public facilities. They are owned and operated by the Department of Food and Agriculture. Maintenance of signs and stripes at these inspection stations are handled through an interagency agreement administered by the Maintenance Program.

Maintenance of all public facility items, including roadway surfacing, signs, pavement markings, buildings, and electrical installations are reported and charged to this Family.

Charging practices for the "G" Family Problems are included the Maintenance Manual Volume 2.

Refer to Section G.05 of this chapter for maintenance levels applicable to this program.

## **G.01 Laws and Regulations**

- (A) Streets and Highways Code, Article 7 (Sections 218 - 227)

This code contains State laws related to Safety Roadside Rest Areas. Topics include planning and design, vending machines, missing children information, and provisions for persons with disabilities.

- (B) Welfare and Institutions Code Section 19403 and Government Code Section 19130

These codes provide for the use of rehabilitation facilities for janitorial services and landscape maintenance in Safety Roadside Rest Areas. For purposes of these sections, rehabilitation facilities are organizations sanctioned by the Department of Rehabilitation.

(C) Public Contracts Code Chapter 4, Article 1 (Sections 12150 - 12158)

These code sections contain State laws related to recycling. Both the Department of General Services and the California Integrated Waste Management Board assist in administering this program.

(D) Title 21, Chapter 20. California Code of Regulations (CCR)

Rules and regulations for the SRRAs are included in this code.

State law requires that rest area maintenance be performed by State forces except at locations where the work can be performed by rehabilitation facilities under the provisions of Welfare and Institutions Code Section 19403. An exception to this requirement is the extremely remote facilities which have been under contract to private vendors, and where the rehabilitation facility services are not available.

**G.02 Policy for Safety Roadside Rest Areas**

The following is the Maintenance Program policy regarding Safety Roadside Rest Areas (SRRAs).

(A) Safety Roadside Rest Areas Standards

- (1) Clean rest room facilities.
- (2) Adequate supply of paper products.
- (3) Grounds that are maintained, unlittered, and attractive.
- (4) Clean parking areas.
- (5) Attractive buildings that are properly painted and repaired.
- (6) Service facilities such as telephones and water fountains that work.
- (7) Public information in well maintained kiosks.

**(B) Minimum Hours of Janitorial Coverage**

The cleanliness of the SRAA facilities depends on adequate janitorial coverage consistent with the level of patronage. Janitorial service should reflect the following minimum hours of coverage:

Patronage (persons per day)	Daily Hours of Coverage
Less than 500	4
501-2,500	8
2,501-4,500	12
4,501-6,000	16
More than 6,000	24

Service contracts should reflect extra coverage, as needed, for peak seasons and for three day weekends.

Patronage (visitor counts) must be determined from actual counts and should be reasonably current.

**(C) Service Contracts for Janitorial Service**

By law, SRRA maintenance must be performed by State forces, unless janitorial services are provided by rehabilitation facilities sanctioned by the Department of Rehabilitation. Caltrans may enter into contracts for janitorial services with rehabilitation facilities.

It is Caltrans policy to utilize these groups whenever possible where their services can be obtained at a reasonable price. Experience on a statewide level with these groups has been consistently satisfactory.

These contracts are negotiated and do not need competitive bidding. Districts are encouraged to develop long term relationships with service providers, and retain providers so long as the costs are reasonable and service levels are satisfactory.

Janitorial service contracts should be written to reflect the minimum hours of coverage listed above in this section. Service contracts should reflect extra coverage, as needed, for peak seasons and three day weekends.

(D) Periodic Inspections

SRRA's should be checked periodically for cracked sidewalks, holes, or depressions in areas where pedestrians are expected.

(E) Closures

Safety Roadside Rest Area (SRRA) closures fall into three general categories as noted below. SRRAs normally should be kept open at all times; however, if closure is considered, the decision should factor impacts to tourism, users, goods movement, service providers, partners, and adjacent facilities. An SRRA closure index (SCI) with key factors has been developed to aid in this process and should be used when considering SRRA closure.

See Appendix G1 for the SRRA Closure Index Worksheet "sample".

In all cases when justified and closed: 1) appropriate signage shall be placed at preceding rest areas or tourist oriented directional signs to notify motorists of the closure; 2) the statewide Maintenance Coordinator and Maintenance Webmaster shall be notified in order to ensure updated information is available and accurate; and 3) stakeholders (motorist, trucking associations, adjacent businesses, chambers of commerce, sheltered workshops, and contractors) should also be notified if closure is of more than a very short duration.

(1) Emergency Closures

An emergency closure is an unanticipated temporary closure of facilities and temporary suspension of service at an SRRA to ensure public health, safety, or welfare. An SRRA should be immediately closed when a condition is determined to be a hazard to the public health, safety, or welfare. Emergency repairs shall proceed with speed and diligence to ensure the closures last no longer than essential, and the SRRA should be reopened as soon as public health, safety, and welfare are no longer compromised. Any Maintenance staff that identifies a potential hazard to public health, safety, or welfare should immediately implement an emergency closure, notify his or her supervisor, and contact any necessary expertise needed to access or assist. The Deputy District Director, Maintenance shall be kept apprised of any emergency SRRA closures and the steps being taken to reopen the facility. The length of the emergency closure shall be approved by the Deputy District Director, Maintenance if it will be more than 5 calendar days.

(2) Intermittent/Seasonal/Economic Closures

An intermittent/seasonal closure is a planned and scheduled temporary closure of facilities and temporary suspension of services at a rest area unit to respond to seasonal issues (such as snow), or an expected or documented reduction in demand during a specified period of time (season, certain days or months). An economic closure is a planned temporary closure of facilities and temporary suspension of services at a rest area unit to respond to extraordinary budget issues. Economic closures may occur after careful consideration has been given to reducing costs at the rest area unit.

Review of the intermittent/seasonal/economic closures and conditions should be reevaluated on an annual basis, or when a significant change in conditions occurs. Closure schedules must be recommended for approval by the Deputy District Director, Maintenance and approved by the District Director in concurrence with the Division Chief for Maintenance. Closure schedules should be determined as early as possible so that notification can be given on contracts, and closures can be coordinated with any contractors providing services at the facilities (i.e. Shelter Workshops, Blind Vendors Program, etc.).

(3) Permanent Closures

Permanent closures must be justified and follow procedures outlined in Chapter 29 of the Project Development Procedures manual.

(F) Maintenance of SRRA Buildings

SRRA buildings should be maintained in the as built condition. Any damage (e.g., broken tiles or fixtures) should be immediately repaired to ensure like new condition. Wood components should be painted, treated, or repaired as necessary to maintain integrity and an attractive appearance. Graffiti should be immediately removed. Districts should exercise care to ensure all facilities are in working order.

(G) Joint Operational Agreement Between Caltrans and California Highway Patrol (CHP)

Caltrans and the CHP have entered into a joint operational agreement to suppress vandalism and illegal activities at SRRAs. Refer to this agreement for remedial actions when operational problems develop involving illicit activities. This agreement provides for SRRA managers when conditions warrant.

(H) Report lost, stolen, or vandalized property to the CHP.

- (I) Unless otherwise provided for by law, vending activities and solicitation of any form is strictly prohibited at SRRAs. This includes the distribution of free refreshments as a fund raiser.

Vending by the Business Enterprises Program and newspaper distributors is provided for in the Streets and Highway Code sections noted above in Section G.02.

### **G.03 Water Quality Concerns**

- (A) Drain inlets in SRRAs, weigh stations, vista points, and Park and Ride lots should be stenciled with an appropriate notice if the drain flows to inland or coastal waters.
- (B) Roadside Fountains

Under the Pure Water Law of the California Health and Safety Code, Section 4031, it is the duty of the Department to take samples of water used for drinking purposes and to ascertain its purity. This is done as often as is deemed necessary under local conditions.

Notify County Health Department when a new fountain is constructed and arrange for periodic inspections either by county personnel or a certified laboratory. It is good practice to watch for unusual circumstances which may contaminate the water.

Where the local health department finds the water to be contaminated, Maintenance should place a white warning sign approximately 48 inches x 25 inches with 4 inch black letters to read: "DO NOT DRINK THIS WATER - FOR RADIATORS ONLY" or other signing approved by the local health officials.

Remove the nipple or fill pipe from the fountain to prevent children from drinking contaminated water.

### **G.04 Levels of Service**

- (A) SRRA Grounds and Buildings Maintenance
  - (1) Planted and Unplanted Areas

Planted areas including lawns, shrubs, and trees shall be maintained in accordance with Maintenance Levels under the "E" Family, Landscaping. Modifications to the landscape design concept should not be made without consulting the District Office of Landscape Architecture.

Unplanted areas shall be maintained in accordance with maintenance levels established in the "C2" Family, Vegetation Control. The one exception is that grasses, other than lawns, shall be maintained below a height of 6 inches.

Plants and lawns must be watered as required according to local climatic conditions. Whenever possible, watering should be done during the early morning hours.

**(2) Fixtures**

Tables, benches, and other fixture tops must be kept free of soil and stains. Hose these fixtures with water and use a general purpose cleaning material.

Table and bench tops should not be sprayed with insecticide nor treated with disinfectant unless the surfaces can be rinsed off immediately with clean water.

Brushes or rags that have been used to clean inside the rest rooms should not be used to clean picnic table tops or benches.

**(3) Pests**

When possible, eradicate harmful insects and pests from the SRRAs. Ants, spiders, wasps, flies, and mosquitoes should be sprayed with appropriate insecticides. The undersides of the tables should be checked for spider webs.

During the season of flies and mosquitoes, the interior of the rest area should be sprayed as frequently as necessary to control the insects.

Consult the District Landscape Specialist for control of pests.

**(4) Paved Areas and Roadways**

Paved walks and roadways shall be swept as needed. All paved areas including floor slabs should be kept free of sand, gravel, grease, and other debris.

**(5) Drinking Fountains**

Drinking fountains should be cleaned, disinfected, and kept free from scale caused by "hard" water. Well, spring, or surface water sources require special testing to ensure compliance with public drinking water standards (Health and Safety Code Section 4029).

**(6) Vandalism**

Vandalism should be reported so corrective measures can be taken without unnecessary delay. Where electrical fixtures have been removed leaving bare wire ends, the circuit breaker should be opened and the wire ends taped as a temporary safety measure until permanent repairs can be made.

(7) Roadside Ecological Viewing Areas (REVA)

Maintenance, repair, or replacement of Roadside Ecological Viewing Area (REVA) sites should be coordinated with the Maintenance Program, Office of Roadside Maintenance.

(B) Rest Room Maintenance

Rest rooms should be serviced as needed. Service will include, but not be limited to the following:

- (1) Sweep and wet-mop all rest room floors with safer alternative cleaners, or hose down where design permits. Major cleaning of the rest room should take first priority of services provided.
- (2) Clean and disinfect all wash basins, toilets, toilet seats, urinals, and drinking fountains. The rest room should be sprayed for insect control, if needed.
- (3) All chrome plumbing connections and mirrors should be cleaned.
- (4) Toilet tissue, towels, soap, and other rest room supplies should be replenished as needed.
- (5) Smudges and writing on walls, woodwork, doors, and glass areas should be removed.
- (6) Wells, pumps, heating systems, and other special facilities should be repaired as soon as possible after malfunction or breakdown is detected.
- (7) Facilities damaged by vandals should be repaired as soon as possible.

(C) Weigh and Inspection Stations

Weigh and inspection stations are in three categories:

- (1) Facilities for portable scales.
- (2) Scales with modest or no buildings.
- (3) Scales with permanent buildings that house full time CHP staff.

Weigh and inspection stations are owned by Caltrans, but are operated by the California Highway Patrol (CHP). Light repair is provided by the CHP through an interagency agreement with Caltrans for occupied facilities. The maintenance of larger facility items is the responsibility of Caltrans. The agreement should be consulted for specific details.

Underbay lights are maintained by Caltrans. Facilities for portable scales are maintained by Caltrans forces.

Additional signs may be placed, as local conditions require, after approval by the District Traffic Engineer.

**(D) Park and Ride Lots**

Most Park and Ride lots are owned and maintained by Caltrans. However, some lots are provided by agreement with the landowner.

All maintenance of Park and Ride lots is the responsibility of Caltrans, unless covered by special agreement. Districts are required to consult the agreement to determine the arrangement for maintenance of non Caltrans-owned facilities.

The Adopt-A-Highway program provides for the adoption of Park and Ride facilities for litter removal and landscaping maintenance.

**(E) Vista Points**

Litter receptacles are normally not provided at vista points. It is important to inspect vista points frequently to keep them presentable.

Kiosks at vista points should be painted as needed and maintained in a clean condition.

Interpretive displays should be inspected periodically and replaced when needed.

Consult the District Office of Landscape Architecture for replacement panels.

The Adopt-A-Highway Program provides for the adoption of vista point facilities for litter removal and landscape maintenance.

July 2006

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APPENDIX G1

SRRA Closure Index (SCI) Worksheet			
<b>Note: If immediate hazard to public health, safety or welfare exists, close the SRRA immediately, provide required signage and notification ASAP</b>		Date _____ SRRA Name _____ Dist _____ County _____ Route _____ Postmile _____ Proposed Closure Period _____	
Choose one factor per item; use <u>0</u> if none of the criteria apply.			
<b>1. Tourism</b>			
<b>2a. Traveler orientation stop</b>		<b>Factor</b>	
SRRA is a significant stop for motorist orientation		10	Enter factor: 2a <span style="border: 1px solid black; padding: 0 10px;">10</span>
SRRA is a source for motorist orientation		5	
<b>2b. Bus stop-over</b>		<b>Factor</b>	
SRRA is regularly used for bus stop over		5	Enter factor: 2b <span style="border: 1px solid black; padding: 0 10px;">5</span>
SRRA is occasionally used for bus stop over		3	
SRRA is rarely used for bus stop over		1	
<b>2. Usage</b>			
<b>3a. Average Annual Daily Traffic of main line</b>		<b>Factor</b>	
Actual AADT = _____			Enter factor: 3a <span style="border: 1px solid black; padding: 0 10px;">5</span>
AADT > 60,000		5	
AADT from 20,000 to 60,000		3	
AADT < 20,000		1	
<b>3b. Stopping factor</b>		<b>Factor</b>	
Actual % of users = _____			Enter factor: 3b <span style="border: 1px solid black; padding: 0 10px;">10</span>
Used by more than 15% of the main line traffic (yearly average)		15	
Used by between 10% and 15% of the main line traffic (yearly average)		10	
Used by less than 10% of the main line traffic (yearly average)		3	
<b>3c. Season or holiday factor</b>		<b>Factor</b>	
Closure will significantly impact peak season and/or 3 major travel holidays		10	Enter factor: 3c <span style="border: 1px solid black; padding: 0 10px;">10</span>
Closure will moderately impact peak season and/or 2 major travel holidays		6	
Closure will minimally impact peak season and/or 1 major travel holiday		3	
<b>3. Spacing</b>			
<b>4a. Resultant Gap between SRRA's</b>		<b>Factor</b>	
Distance exceeds 140 miles		15	Enter factor: 4a <span style="border: 1px solid black; padding: 0 10px;">15</span>
Distance is between 100 and 140 miles		10	
Distance is between 60 and 100 miles		5	
Distance is less 60 miles		3	
<b>4b. Alternative stopping facilities (water, phone, auto parking, restrooms) within ~1 mile of the highway</b>		<b>Factor</b>	
No alternatives are available within 60 miles for general traveling public		10	Enter factor: 4b <span style="border: 1px solid black; padding: 0 10px;">10</span>
No alternatives are available within 30 miles for general traveling public		7	
Alternatives are available but capacity, access and hours are limited		4	
<b>4c. Alternative truck and long vehicle stopping facilities</b>		<b>Factor</b>	
No alternatives are available within 60 miles		10	Enter factor: 4c <span style="border: 1px solid black; padding: 0 10px;">10</span>
No alternatives are available within 30 miles		7	
Alternatives are available but capacity, access and hours are limited		4	
<b>4d. Closure Impacts on other SRRA's, districts &amp; neighboring states</b>		<b>Factor</b>	
Adjacent SRRA's will significantly be adversely affected or exceed capacity		5	Enter factor: 4d <span style="border: 1px solid black; padding: 0 10px;">5</span>
Adjacent districts or neighboring states will be adversely affected		3	
Closure will have moderate impacts on neighboring SRRA's, districts or states		2	
<b>4. User Cost (taking into account any attempted measures to reduce costs)</b>			
Actual User Cost = _____			Enter factor: 1 <span style="border: 1px solid black; padding: 0 10px;">20</span>
(current statewide average cost per user is \$0.21)			
Service costs are less than state average		20	
Service costs are between 1 and 2 times state average		10	
Service costs are between 2 and 3 times state average		5	
<b>CALCULATED SCI =</b>			<b>100</b>
If SCI > 70 SRRA should remain open except for emergency closures If SCI is between 40 and 70 SRRA may be considered for seasonal or economic closures If SCI < 40 SRRA is good candidate for seasonal or economic closures			

# **CHAPTER H**

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## **H.00 Introduction**

This chapter covers the maintenance of bridge structures that are 20 feet or longer between abutments, and special structures such as seal slabs and major retaining walls, that are identified by assigned bridge numbers. The work performed will be under the HM3, “H” Family in the Maintenance Program. Work on bridge structures less than 20 feet long, primarily large culverts, is included in the HM2 Roadside Program.

Bridge maintenance includes work such as repairing damage or deterioration in various bridge components, removing debris and drift from piers, bearing seats, abutments, etc., cleaning out drains, repairing expansion joints, cleaning and painting structural steel, and sealing concrete surfaces. Also included are the maintenance of electrical and mechanical equipment on moveable span bridges, and the operation of the moveable spans.

Refer to the Maintenance Manual Volume 2 for planning, scheduling, and administrative procedures connected with the HM3, “H” Family.

## **H.01 Maintenance Levels**

Bridge maintenance work can be grouped into two categories; work initiated by the district, and work recommended in Bridge Inspection Reports.

Work initiated by districts is generally in response to a problem on a bridge that affects public safety or the structural integrity of the structure.

Work recommendations in Bridge Inspection Reports are the result of periodic engineering inspections performed by Area Bridge Maintenance Engineers (ABME’s) from Structure Maintenance and Investigations (SM&I). This work can generally be accomplished on a planned basis, and is expected to be accomplished within two (2) years of the date of recommendation. However, when the work is of a critical nature, the ABME will immediately contact the district and verbally transmit instructions regarding the work required. This will be followed by a Bridge Inspection Report covering the work recommended.

When work recommendations are made, the recommendations will suggest the work be done either by contract or by Maintenance crews. These recommendations are for guidance and the district has the flexibility to accomplish the work by any means available. However, it should be noted that many of the repair recommendations affect structural components and are engineered solutions, therefore the repair recommendations, methods, and procedures shall be closely adhered to.

Because structural considerations are involved, no changes or deviations shall be made without the concurrence of the ABME. Descriptions of major or minor defects are listed in the following sections of this chapter.

## **H.02     Inspections by Area Bridge Maintenance Engineers**

To comply with federal regulations, all bridge structures over 20 feet long shall be inspected by qualified Bridge Maintenance Engineers at a maximum interval of two (2) years, and more frequently if conditions require a more frequent inspection. As part of the inspection, an engineering evaluation is made regarding the condition of all structural components, and work recommendations are made for any corrective actions required.

A summary of all Bridge Inspection Reports is forwarded monthly to the Deputy District Director for Maintenance, who is responsible for scheduling and accomplishing the work recommendations in a timely manner. Copies of the Bridge Inspection Reports can be viewed through the SM&I Website at <http://smi/> using the “BIRIS” link.

Each work recommendation is identified by action type, target completion time, and accompanied by an estimated cost to do the work. A computer listing of all current and outstanding work recommendations can be viewed by visiting the SM&I website at <http://smi/> and activating the “Outstanding Work” link or the “Work Extract/LOS” link. Work that has been completed can be checked as work done through this same web page.

Work recommendations frequently contain recommendations that the work be done by contract. However, the districts may elect to do the work with their own forces, provided that the work is within statutory and policy limitations on work by Maintenance forces.

When work is to be done by contract, SM&I will prepare the PS&E, except for traffic handling, upon the issuance of an Expenditure Authorization (EA) by the district. Scheduling of projects will be a joint effort between SM&I and the district.

## **H.03     Inspections by District Maintenance Supervisors**

Periodic walk through inspections shall be made by District Maintenance Supervisors to detect obvious defects, hazards or potential problems, and also to monitor known problems. Refer to the “Levels of Service” section in Maintenance Manual Volume 2 for frequency of these inspections. The purpose of these inspections is to supplement the more detailed, but less frequent inspections by the ABME. Special attention should be given to any condition that affects the safety and/or structural capacity. If there is a question as to the relevance of a structural condition, the ABME shall be notified.

When major defects or hazards are found, they shall be immediately reported to SM&I by telephone. If an emergency condition exists, appropriate action shall be taken as soon as possible to ensure the safety of the traveling public and to prevent further structural damage from occurring. This includes, but is not limited to, restricting traffic on the bridge or closing it completely, installing temporary support systems, or making temporary repairs. SM&I will immediately send out an ABME to evaluate the condition of the structure and direct necessary repairs.

After a major storm, earthquake, or other natural event that may cause damage to bridges, area supervisors shall inspect all bridges in the affected area for signs of damage. Any damage found should be reported to SM&I.

Structures less than 20 feet long are not inspected by SM&I. These structures are generally the larger culverts and other minor structures. These structures should also receive periodic walk through inspections. See Chapter “C5” of this manual for instructions regarding inspection of these structures. Also, see the Caltrans Storm Water Quality Handbook – Maintenance Staff Guide.

#### **H.03.1 Post Earthquake Inspections**

Post earthquake inspections of bridges will be conducted by area supervisors, SM&I ABME's, and Structure Construction Engineers depending on the level of intensity and extent of damage based on the following general protocols :

##### **Richter magnitudes less than 5.0:**

Bridge damage resulting from these magnitudes is generally not expected. However, specific site conditions can increase the possibility of damage.

For events less than 5.0, cursory inspections of bridges within a 10-mile radius of the epicenter shall be performed by district Maintenance crews as part of routine maintenance operations.

If damage is found, then area supervisors shall inspect all bridges within the affected area. If significant damage is detected, then the affected radius should be increased to 25 miles. SM&I shall be immediately notified of any earthquake-related damage.

**Magnitudes 5.0 to 6.0:**

Bridge damage resulting from these magnitudes is possible. Specific site conditions can make damage probable.

For events between 5.0 and 5.5, area supervisors shall inspect all bridges within a 25-mile radius of the epicenter. If significant damage is detected, then the affected radius should be increased to 50 miles. SM&I shall be immediately notified of any earthquake-related damage.

For events between 5.5 and 6.0, area supervisors shall inspect all bridges within a 50-mile radius of the epicenter. If significant damage is detected, then the affected radius should be increased to 75 miles. SM&I shall be immediately notified of any earthquake-related damage.

For events over 5.0, SM&I will concurrently prepare for mobilization of ABME's to the affected area. SM&I Engineers will analyze the location of the epicenter, Richter intensity, peak rock acceleration, locations of bridges in the area, and reports of damage from field maintenance. Based on the results of that analysis, SM&I will determine if ABME's will be mobilized to perform engineering investigations. Area supervisors will be notified of these efforts.

**Magnitudes over 6.0:**

Bridge damage resulting from these magnitudes is probable. Specific site conditions can increase the probability of significant damage.

For events over 6.0, area supervisors shall inspect all bridges within a 50-mile radius of the epicenter. If significant damage is detected, then the affected radius should be increased to 75 miles. SM&I shall be immediately notified of any earthquake-related damage.

For events over 6.0, SM&I and Structure Construction Engineers will prepare for mobilization based on the above criteria. If widespread damage is obvious, SM&I ABME's and local Structure Construction Engineers may immediately conduct independent damage inspections of bridges. SM&I will act as lead to coordinate systematic bridge damage assessment. Area supervisors shall be notified of these efforts, and may act as lead until SM&I are fully mobilized. region or area Maintenance stations may be used as central locations where bridge damage assessment efforts will be coordinated.

#### **H.04 Movable Span Bridges - Inspection and Testing**

The mechanical and electrical equipment of movable span bridges will be inspected once a year by qualified mechanical and electrical Engineers from the Division of Engineering Services Office of Electrical, Mechanical, Water and Wastewater Engineering (OEMW&W). An inspection report will be forwarded to the appropriate districts that will include work recommendations deemed necessary based on the inspection. For bridges that are not open regularly for waterway traffic, the spans should be opened at intervals frequent enough to ensure that all mechanical and electrical equipment are functional. Diesel or gasoline powered engines should be operated at least once every two (2) weeks. SM&I will conduct structural inspections on a biennial frequency, and an engineering report will be made.

#### **H.05 Definitions**

The SM&I assigns an official bridge number and name to all "Bridges" meeting the following criteria:

- (A) All structures which, measured parallel to the roadway centerline, have a length of more than 20 feet between the inside faces of the end abutments shall be carried as bridges regardless of the length of the spans making up this total.
- (B) In addition, bridge numbers may be assigned to other structures where periodic inspections with written reports are desired. This includes such structures as very large retaining walls, mechanically stabilized earth walls, seal slabs, specially designated culverts, and other unique structures.
- (C) The name assigned to each structure given a bridge number has an association with its function as a highway facility. Name types are defined below and illustrations can be seen in Appendix H-1.

- (1) Bridge

This term is used in a name when the function of the structure is to carry traffic over a watercourse such as a bay, canyon, river, creek, wash, or slough.

- (2) Overhead

This term is used in a name when the function of the structure is to carry a State highway over a railroad.

(3) Underpass

This term is used in a name when the function of the structure is to carry a railroad, and provides for passage of a State highway under the railroad.

(4) Overcrossing

This term is used in the name of a structure when a county road, city street, or any facility (pipelines, tramways, pedestrian crossings, cattle-passes, equestrian crossings, etc.), other than railroads, is carried on the bridge structure and State highway traffic flows under the structure.

(5) Undercrossing

This term is used in the name of a structure that carries State highway traffic and provides for passage of a city street, county road, or other facility other than a railroad or another State highway, under the State highway.

(6) Separation

This term is used in the name of a structure that carries traffic of one State highway over another State highway.

(7) Viaduct

This term is used in the name of a structure of any length that carries State highway traffic along a steep side hill. It also is used as a compromise name for a long structure crossing over several facilities of approximately the same importance, any one of which alone would require a name category of Bridge, Overhead, Undercrossing, or Separation.

(8) Tunnel

This term refers to a roadway section through a mass of earth. Some undercrossings and separations are also tunnels.

(9) Tube

This term describes an underwater roadway facility constructed by lowering a prefabricated section in an excavated trench.

(10) Pumping Plant

This term is used in the name of a facility that is assigned a bridge number because it is an intricate facility of structural, mechanical, and electrical combination for the purpose of preventing water inundation of the highway.

**H.06 Minor Defects**

Minor defects are those that can be corrected with little or no risk of structure collapse or rendering of damage to adjacent or related members while making repairs or replacements.

Listed here are some examples of this class of defect:

- (A) Damaged or misplaced clearance markers.
- (B) Damaged or missing advisory and warning signs (Speed and/or Weight Limit, Vertical Clearance, Narrow Bridge, One Lane Bridge, One Lane Bridge for Trucks and Buses).
- (C) Scaled or deteriorated paint on timber railings and curbs.
- (D) Damaged or deteriorated railings and curbs.
- (E) Uneven or cracked approach and deck surfacing.
- (F) Broken or loose timber decking.
- (G) Accumulated drift adjacent to bents and piers.
- (H) Minor erosions.
- (I) Accumulated dirt or debris on decks, near stringer ends at supports, adjacent to bearings, and on chords of trusses.
- (J) Plugged drains.
- (K) Settlement or roughness of approach.
- (L) Fire hazards.
- (M) Faulty electrical contacts.

### **H.07 Major Defects**

Some defects are considered major because they involve individual members that affect structural stability of an entire span, thus requiring underpinning of the span or supplementing of the member before removal. Others are included in this group because the cause of the defect, and thus the measures needed to correct the defect, are numerous and varied requiring structural or other technical advice, or the defect may cause equipment failure. Examples of this type of defect follow:

- (A) Bent or damaged steel beams, girders, or truss members.
- (B) Cracked or spalled concrete members, other than curb and railing.
- (C) Crushed or decayed timber stringers, caps, posts or piles.
- (D) Broken or weakened chord members of failed truss joints.
- (E) Unusual looseness or vibration of truss members.
- (F) Loosened or decayed timber deck over an extended area.
- (G) Defective bearings on substructure or in deck at expansion joints.
- (H) Settled bents or piers.
- (I) Major erosion or scour.
- (J) Lack of paint on steel members, other than curb and railing.
- (K) Extensive fire damage.
- (L) Poor alignment or balance of movable bridge spans.
- (M) Excessive noise or vibration from operating machinery.
- (N) Lack of lubricant in machinery bearings.
- (O) Loose bolts.
- (P) Broken timber stringers.
- (Q) Ineffective supplemental bents.

## **H.08 Repair Materials and Procedures**

When making repairs of defects, whether minor or major, all work shall conform as closely as practicable to requirements of the current Standard Specifications. Emergency and temporary work shall be planned to best meet the situation and protect traffic. Wherever applicable in all work, materials and procedures listed in this section should be used, unless variation from these are stated in the work recommendation listed in the reports submitted by SM&I, or upon approval of the variation by the ABME.

### **H.08.1 Epoxy for Patching, Bonding, and Filling Voids in Concrete**

Epoxy is a two component mixture that will adhere to most clean hard substances such as steel and concrete. When cured, it forms a strong material that can be used in certain structural repairs.

Epoxy can be pumped into cracks in concrete to re-bond the separated pieces, pumped into voids in concrete such as rock pockets or spaces between steel expansion dams and concrete deck, and used as bonding agent between original concrete and new concrete or mortar. It is also used as cement in place of Portland cement and water in mortar for patching or replacing concrete such as grout pads.

Two-component epoxy shall be carefully proportioned in accordance with directions supplied by the manufacturer. The two components shall be mixed thoroughly before using and placed immediately after mixing.

Pot life of the mixed epoxy varies with the temperature of the material. When confined, the heat produced by the chemical reaction is not dissipated from the mix so the epoxy becomes progressively warmer and the chemical reaction becomes progressively accelerated. In confined lots, the pot life may be only a few minutes. The time required to harden is increased many fold by spreading out the material so its heat from chemical reaction is conducted away. If the epoxy is frozen immediately after mixing, the chemical process can be virtually stopped. So, by artificial heating or cooling, the time of set can be sped up or slowed down as is desired.

For proper final cure, the temperature of the epoxy should be a minimum of 65°F for several hours. When heating to accelerate the curing, a direct flame should not be applied to the epoxy surface. A 1-inch cover of sand, or a steel plate supported to clear the epoxy surface by 1 inch or more, makes an effective protector from the flame. Either conducts the heat effectively to the epoxy. Never heat the epoxy to the boiling point or flame point.

To pump epoxy into cracks or voids, use a grease gun with Alemite fittings. If the void is behind a steel plate, a hole can be drilled through with the proper diameter to receive a drive fit Alemite fitting. Cracks in concrete, or voids to be filled, can be pumped by inserting ½ inch pipes held in with epoxy or PC grout, or may be driven into a closely sized drilled hole in sound concrete, and fitted with an Alemite nipple at the exposed end. Open cracks to be pumped must be sealed along edges in advance of pumping with an epoxy containing a thixotropic agent to prevent flowing away before setting. Other surface mounted fittings specifically designed for epoxy injection may also be used.

Epoxy mortar can be produced by adding sand and gravel to the previously mixed two component epoxy. For large batches, this can be done most satisfactorily by adding the aggregates slowly to the mix in a clean bucket while stirring with a mechanical mixer such as a 3/8 inch rod bent to a "D" end and turned with an electric or air operated drill. Aggregates can be added until a satisfactory mix is obtained. Proportions between 4 and 10 parts of aggregate to 1 part of epoxy have been used for grout pads under masonry plates and patches in concrete.

Any tools or equipment used with epoxies must be cleaned before the epoxy has set (the sooner the easier), or it will be impossible to wash the epoxy off. Toluene, methylethylketone, or lacquer thinner, may be used to clean tools. Use caution with these materials, as they are flammable and can be hazardous to health. Be sure to follow all label instructions.

The ingredients in epoxy are toxic to humans and livestock if taken internally. Many people are allergic to contact with the ingredients. For these reasons, it is advisable to wear waterproof gloves when mixing and applying epoxy. Inexpensive polyethylene gloves can be discarded after use. They can be obtained from Material Operations. Use soap and water to remove the ingredients from the skin.

The two epoxy components can be stored in sealed individual containers for several years without detrimental effect. If stored for several months or more, the contents of each container must be stirred thoroughly before proportioning the mix.

Epoxies suitable for the above uses can be obtained from the Transportation Laboratory.

## H.08.2 Portland Cement Concrete and Steel Reinforcement

During concrete placement, mechanical vibrators shall be used to consolidate the concrete mix. Aggregates shall be clean and well graded. No more water shall be used than is necessary to provide a workable mix. Reinforcing steel shall be placed as shown on plans and securely held in position when placing concrete. Forms shall be constructed adequately to prevent leaks and to hold in proper line and grade while placing and curing the concrete.

There are many rapid setting high-strength concrete materials available for structural repairs and patches. These materials consist of either magnesium phosphate concrete, modified high alumina based concrete, or Portland Cement based concrete. The number of products available for patching purposes is too voluminous to mention here. There is a document entitled "Rapid Set Materials for Repairs to Portland Cement Concrete Pavement and Structures" produced by the Office of Rigid Pavement Materials and Structural Concrete at Translab that lists products by trade name that have passed acceptance testing. The ABME's have a copy of this document. It discusses characteristics and the do's and don'ts. It is important to note that the materials in this publication are not pre-approved. Lots are acceptance tested.

Contact the Office of Rigid Pavement Materials and Structural Concrete to verify that a particular lot of material has been approved for use.

There is a co-polymer called High Molecular Weight Methacrylate (HMWM). This product is especially good for filling cracks in concrete and knitting the concrete together. Special precautions are required when using it. Refer to "Code of Safe Operating Practice - Bridge and Highway Concrete Repairs Using HMWM Resins."

The following table gives approximate quantities of materials needed to produce one (1) cubic yard of each of several classes of Portland Cement concrete. These mixes produce a mix with about a 4-inch slump if the aggregates are well graded. Adjustments must be made to produce a workable mix with proper yield.

Class	Cement Sacks = Pounds	Combined Aggregates Pounds = Cubic Yards (loose measure)	Water Pounds = Gallons
"A"	6 = 564	3200 = 0.99	290 = 35
"B"	5 = 470	3320 = 1.03	290 = 35
"C"	4 = 376	3440 = 1.06	267 = 32
"D"	7 = 658	3150 = 0.97	290 = 35

Mortar for patching, etc., can be composed of well-graded sand and cement in the following approximate proportions measured by volume:

Cement.	1 Part
Sand	3 Parts
Water	Sufficient to make a stiff mix

Additives should not be used without approval of the Area Bridge Maintenance Engineer. Steel reinforcing bars must comply with ASTM Designation A706/A706M. The English bar numbers are based on the nearest number of 1/8 inch included in the nominal diameter of the bar.

English	3	4	5	6	7	8	9	10	11	14	18
Metric	10	13	16	19	22	25	29	32	36	43	57

The weights have been adopted as standards. Bar number 2 is produced in plain rounds only. Existing bars shall be replaced with bars of equivalent cross sectional area. When replacing square bars with round, use the next larger round bar size (i.e. replace a 5/8" square bar with a #6 round bar).

Splicing of reinforcing bars must comply with Section 52-1.08 of the Standard Specifications. This section covers welded, mechanical, and lap splices. In general, lap splices may be as follows: Number 8 and smaller bars shall be lapped at least 45 bar diameters of the smaller bar joined, Number 9, 10 and 11 bars shall be lapped at least 60 bar diameters of the smaller bar joined. Number 14 and 18 bars may not be lap spliced.

When joining new concrete to old, chip or saw 1/2 inch or deeper along edges of concrete to be repaired to eliminate feather edges and produce neat, straight line joints. Chip away all unsound and loose fragments of concrete within the repair area. Remove all foreign material and rust from concrete and steel by sandblasting or wire brushing. When patching spalls, chip about 1 inch under the reinforcing steel in several locations to help anchor the patch, or apply two-component epoxy to bond the entire surface to be repaired (see Section H.08.1). Then place mortar or Portland Cement Concrete to replace all missing concrete. However, it should be noted that Rapid Set materials do not require the use of an epoxy bond coat.

The color of new mortar or concrete shall be made to match original concrete when it is cured. This usually can be accomplished by preparing a combination of 1/3 white cement and 2/3 normal cement for use in making the concrete or mortar. The proportion of white cement should be varied as required.

Strike off and finish of patches shall be done with wood or stone floats only. Steel floats impart a dark color to the surface.

Rapid setting concrete or mortar shall be cured as recommended in "Rapid Set Materials for repair to Portland Cement Concrete Pavement and Structures." All other concrete or mortar shall be cured by keeping damp with water for 7 days, or by coating with an approved colorless curing compound.

#### H.08.3        Steel

Steel members in structures shall be repaired by replacing all or part of the member, straightening, welding tears, and welding or bolting scabs over defects.

Heat can be of great assistance in straightening members if strategically applied, but shall not be used without the approval of the ABME. When such approval is given, the member must be relieved of all dead and live load before heating.

Only common mild "carbon" steel members shall be heated. The maximum temperature shall not exceed 1300° F. At that temperature, common mild carbon steels are reduced in yield point and ultimate strengths to about 10 percent of their values at 100° F. When cooled off they return to approximately original strength and characteristics. Some of the high strength steels are decidedly changed by such heat cycles.

High strength bolts of the same diameter as the rivets removed shall be used to replace rivets in re-assembly. These bolts may be satisfactorily tightened by properly using pre-painted load indicating washers.

All welding shall be done by a certified welder. The type and location of welds can dramatically reduce the fatigue life of a member. Welding on any bridge structural component shall not be performed without the approval of the ABME.

**H.08.4          Timber**

Timber members in structures shall be repaired by replacing or supplementing.

**H.08.5          Deck Surfacing**

Because it adds additional load on a bridge, deck surfacing shall not be placed without prior written approval from SM&I.

Surfacing for concrete bridge decks shall be polyester concrete or an approved multi-layer polymer concrete overlay unless otherwise specified by SM&I. Multi-layer polymer concrete overlays shall be used to increase skid resistance only and should not be used for other purposes. The surfacing shall be placed by conventional methods and adjusted to produce a smooth riding surface.

The use of asphalt concrete (AC) as surfacing for concrete decks shall be avoided. AC surfacing obscures developing deck problems such as cracking and delamination can accelerate existing problems such as alkali-silica reactivity (ASR or “reactive aggregate”), and constrains preventive maintenance and rehabilitation methods without removal of the surfacing. In limited site-specific locations, AC surfacing may be considered for use. The use of all AC surfacing for concrete bridge decks requires prior written approval from SM&I.

For timber or thin steel plate decks, AC surfacing is appropriate. In these applications, the asphalt binder, aggregate gradation and proportioning must be adjusted to produce a mix which will adhere well, be relatively impervious, have above average flexibility and provide a skid resistant surface. Usually these qualities can be achieved with an open graded mix placed over a heavy asphalt seal application on the deck. Climatic, environmental and traffic usage shall be considered in asphalt selection and mix proportioning. The surfacing shall be placed by conventional methods and adjusted to produce a smooth riding surface.

When surfacing highway approaches to a bridge with AC, taper the new surfacing down to a smooth junction with the deck grade at the paving notches. The approaches should be ground down about 1 inch near the paving notch so that the new surfacing maintains about a 1 inch minimum thickness at the transition to prevent raveling.

## **H.09 Repair and Reconstruction**

### **H.09.1 Timber Stringers In Reconstruction**

Salvaged stringers, if in good condition and of the proper size, may be reused. Tops of stringers shall be lined up to a true plane and placed with the same edge up as when formerly used. Stringers shall be cut to a length not exceeding the distance center to center of caps or floor beams by more than 1 foot. The length shall be sufficient to provide at least 6 inches bearing at each end. When using new stringers, it is necessary to inspect for knots, and to place stringers so that the greatest volume of knots are in the upper third.

If knots are in the middle third, they must be placed with the greatest volume above the centerline.

### **H.09.2 Timber Stringers In Existing Bridge as Supplement or Replacement**

A stringer to be placed in an existing span shall be of the same depth and of equal width as other stringers in the panel, when the replacement stringer is of the same kind of material as the existing stringer. When Douglas Fir (DF) stringers are used to replace or supplement Redwood (RW) stringers, the DF stringer should have the same depth, but may have two-thirds of the width of the RW stringer. In case of an emergency, the best available sizes may be temporarily used.

It is acceptable to keep bridging in place, and to set additional pieces as necessary. See Appendix H-1 for cuts required and method to use when installing a supplemental stringer or replacing an existing one.

No attempt shall be made to fit stringers to deck sag by use of an adz. The end wedges must be set to bring the stringer to same degree of tightness against deck at the center of span as adjacent stringers. As the new stringer acquires sag and fits into place, wedges should be tightened. Wedges should always be secured in place with double-headed nails.

The portion of each upper edge of each stringer that extends beyond the center of bent shall be tapered down so it does not contact the bottom of deck. This is to prevent the deck from being pushed up over supports when the stringer is deflected under live loads.

If shims or wedges are necessary under stringers, they shall be substantial and of either Douglas Fir or Redwood, and shall be tacked with double headed nails when set. Shingles are acceptable for the purpose.

### **H.09.3 Supplemental Bent**

When an emergency occurs requiring immediate installation of a supplemental bent, approval by the SM&I must be obtained in all cases. Details of a supplemental timber bent can be seen in Appendix H-1.

In constructing and maintaining a supplemental bent, shims may be used as required so that all stringers bear on the cap. Shims placed under posts shall be the full width of the post plus 1-inch. A series of thin shims should never be stacked. A block or plate plus two shims or just two wedges should be used. Shims or wedges must be nailed with double-headed nails.

When a bridge supplemental bent washes out or is compromised, it shall be replaced immediately. If replacement is not possible the ABME shall be notified immediately, as the bridge may need to be posted for restricted load until strengthened.

### **H.09.4 Bridge Rail**

Damaged or deteriorated concrete railing usually will require recasting of the affected areas with new concrete. Minor spalls in the concrete surface can be patched with portland cement mortar. Concrete cracks may be injected with epoxy.

Steel railing frequently is so extensively damaged that replacement of panels is more economical than straightening or replacing miscellaneous pieces. When a panel of prefabricated railing is to be replaced, it is expedient to purchase it from the original fabricator because he is the only one who has the shop drawing available and therefore is in position to make a quick delivery.

When it is necessary to replace or repair a substantial amount of damaged or deteriorated concrete or metal railing, SM&I shall be notified and will furnish approved details.

Timber rail and wheel guards have many variations and designs. When small portions are damaged, it shall be replaced in kind. If all, or practically all, of any timber rail and wheel guard must be replaced, the entire rail and wheel guard shall be replaced as necessary to convert it all to the standard shown in Appendix H-1, or all shall be replaced with a metal beam rail subject to approval by SM&I.

**H.09.5 Temporary Bridge**

In the event an existing bridge washes out or is destroyed by some other means, the SM&I shall be notified immediately. SM&I will advise on an immediate plan of action and will furnish plans for both temporary and permanent repairs. When such a structure is necessary, SM&I will decide the appropriate type to be built based on materials available, obstacle to be crossed, conditions at the site, and other related factors.

**H.10 Miscellaneous**

**H.10.1 Preventive Maintenance**

Maintenance forces shall take necessary precautions, and perform various acts of maintenance that will prevent conditions that could contribute to the defects listed in Sections H.06 and H.07.

**H.10.2 Mark High Water**

A record of the highest high water mark for major streams shall be indicated by painting a white line 1 inch wide and 18 inches long, together with the date on any convenient abutment, pier, or column.

Records shall also be made of abnormally high water, unusual flow conditions, and any other peculiar conditions during high water periods. These conditions tend to cause scour of the streambed or bank, and can alter the channel flow.

**H.10.3 Approach Surfacing**

When resurfacing the highway, the new surfacing should be tapered down to a smooth junction with the existing deck grade at the paving notches or the approach slabs.

**H.10.4 Bridge Numbers, Names, and Date Built**

The bridge number, name assigned to each bridge by SM&I, and the year it was built shall be plainly stenciled on each structure in a position visible to traffic. Name signs are to be installed at bridges where structure or stream is of sufficient size or importance to justify publicizing its name. Installation of this sign shall conform to requirements of the Traffic Manual, and approval of the Traffic Operations Program. Typical name types are shown in Section H.05.

Locations at which names, numbers, and dates should be painted are depicted in the sketches in Appendix H-1. The lettering should be about 2 inches high and in black or white to contrast with the background provided by the structure. Backgrounds should not be painted for purposes of enhancing the lettering.

#### H.10.5 Vertical Clearance

Every structure over a State highway having a vertical clearance of 15 feet 6 inches or less, exclusive of shoulders, shall have the clearance indicated by a sign in adherence to Traffic Operations Program Directive Number 00-03 dated August 25, 2000 “Vertical Clearance Sign Policy.” This policy applies to all underpasses, overheads, viaducts, overcrossings, undercrossings and grade separations. Per the adoption of the 2003 MUTCD as of May 20<sup>th</sup>, 2004, the following sign codes are now the current codes for vertical clearance signing in California:

- W34 (CA) was replaced with the Federal W-12-2 Low Clearance sign for use in CA.
- W34A (CA) Distance Ahead Plaque has been retained for use in CA.
- W34B (CA) was replaced with the Federal W12-2P \_\_\_\_ FT \_\_\_\_ IN plaque for use in CA.
- W34C (CA) CAUTION VERTICAL CLEARANCE \_\_\_\_ ’ \_\_\_\_ ” Arrow has been retained for use in CA.

The CA sign specifications, W34A and W34C, can be found at the following webpage: <http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm>, under the Warning section. The Federal sign specifications, W12-2 and W12-2P can be found in FHWA’s Standard Highway Sign book, or on the internet at: [http://mutcd.fhwa.dot.gov/ser-shs\\_millennium.htm](http://mutcd.fhwa.dot.gov/ser-shs_millennium.htm). Policies for all 4 signs are contained in both the MUTCD 2003, and the MUTCD 2003 CA Supplement.

Any time there is a planned reduction in vertical clearance of a structure, Maintenance Area Superintendents and supervisors shall be responsible to notify the Caltrans Regional Transportation Permits Liaison Engineer not less than 15 days prior to the change. Notification shall be in writing and a clearance diagram shall be attached. Clearance Diagram Form Std TR-0019, TR-0020, and TR-0029 can be obtained from Forms Flow on the Caltrans Intranet. Samples of these forms are shown in Appendix H-2 and Appendix H-3. SM&I shall also be notified in writing of the change, and a clearance diagram shall be sent to the Area Bridge Maintenance Engineer. If there is a reduction in vertical clearance due to unplanned events, the Caltrans Regional Transportation Permits Engineer shall be notified immediately, and a revised clearance diagram shall be sent to both the Permits Office and SM&I.

If a new roadway surface is being placed on a section of roadway that travels under a structure, the new roadway surfacing can be feathered out to meet the existing surface grade under the structure a short distance in advance, with no reduction in vertical clearance under the structure.

#### **H.10.6 Weight and Speed Restrictions**

In order to safeguard the traveling public and the structure, the Department has authority, under Section 124 of the Streets and Highways Code, to restrict the use of, or close a bridge considered in imminent danger of failure under legal loads. In such cases, weight limit signs of cloth shall be posted immediately, showing the safe weight limit for the structure. These temporary signs are available from Material Operations. Each district shall have a small supply on hand for immediate use, should they be required.

Permanent limit restrictions are established by order of the Department of Transportation, following an engineering investigation and public hearing as prescribed in Sections 35750, 35751 and 35752 of the Vehicle Code.

The investigation is conducted by SM&I. The hearing is held by an appointee of the Director, usually an employee of SM&I.

These laws require a notice of the hearing be posted upon the bridge at least five (5) days before the date of hearing. This shall be done by placing copies of the formal "Notice of Hearing" attached to plywood boards at both ends of the structure in locations visible to traffic. One copy of the formal notice, showing time and date of posting, hearing, and signed by the person erecting the notice, shall be returned to Headquarters Office.

The restrictions ordered by the Director are effective and binding upon the public only after signs stating the limitations are erected, and enforceable only while such signs are in place.

#### **H.10.7 Safety Measures**

For detail as to guardrail, clearance markers and warning and regulatory signs applicable to bridges, see Chapter "M" of this manual.

#### **H.10.8 Fire Protection**

Suitable fire extinguishers shall be installed in each control room and machinery room of each drawbridge. In drawbridges where electricity is the prime source of power, only Dry Chemical or Carbon Dioxide extinguishers shall be installed.

#### H.10.9 Electrical Equipment

Repair or adjustment, of electrical equipment, shall be done by qualified personnel only.

Permanent changes in the circuitry of drawbridges shall not be done without consulting SM&I. This is not intended to prevent electricians from making necessary emergency connections.

#### H.10.10 Lubrication

Standard items of manufacture such as electric motors, engines, compressors, gear reducers and pillow blocks incorporating sealed ball or roller bearings are usually furnished with maintenance manuals, which include recommended lubrication practices. These manuals shall be made a part of the Maintenance Manual in the control room, and the recommended lubrication practices shall be followed exactly, unless overruled by "Specific Lubrication Instructions."

Lubrication of open gears, wire ropes, and sleeve bearings must be varied to meet the conditions under which they operate. Open gears seldom used and subject to accumulation of sand or dirt will be better protected and get less wear by painting with State Specification 8010-61J-45 paint, and leaving all oil or grease off the teeth. Due to the great variation in proper lubrication requirements of somewhat similar facilities, the proper practice for each drawbridge will be covered in Specific Lubrication Instructions.

The manufacturer's manual and the Specific Lubrication Instructions for each bridge shall be made a part of the Special or Supplemental Orders included in data posted in each control room.

#### H.10.11 Overhead and Changeable Message signs

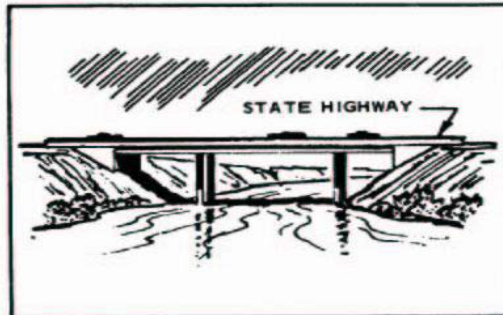
Inspection and maintenance of these signs is covered in Chapter "M" of this manual. SM&I provides inspections and reports, as requested by the district.

#### H.10.12 Horizontal Restrictions

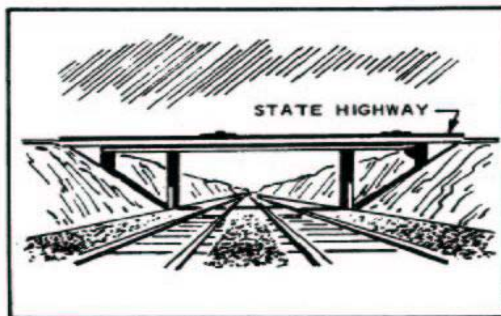
Maintenance Area Superintendents and supervisors are responsible to notify the Regional Transportation Permit Liaison Engineer of any permanent or semi-permanent horizontal restriction that will reduce usable highway width. Notification shall take place at least 15 days prior to placing any device that would reduce horizontal clearance. Such restrictions may include, but are not limited to, the placement of temporary K-rail or any channelizing device that cannot be immediately removed by Maintenance forces. The notification shall be in writing, either by memorandum or departmental e-mail.

APPENDIX H-1

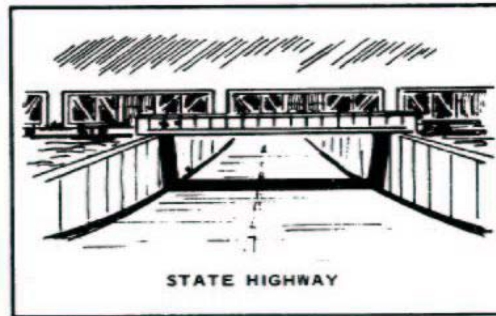
Naming conventions for structure types.  
For definitions see H.05 (C)



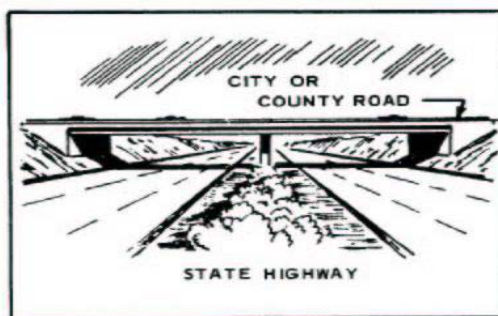
**BRIDGE**



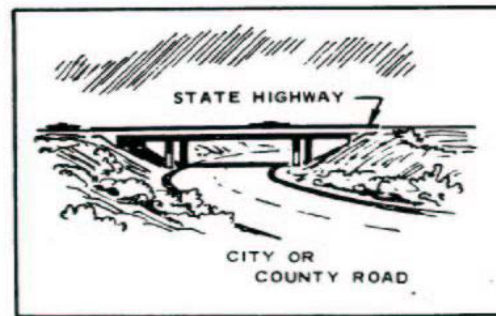
**OVERHEAD**



**UNDERPASS**

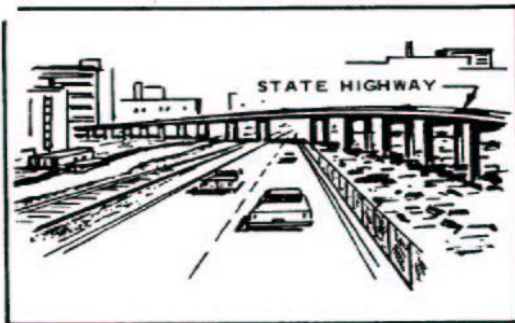


**OVERCROSSING**



**UNDERCROSSING**

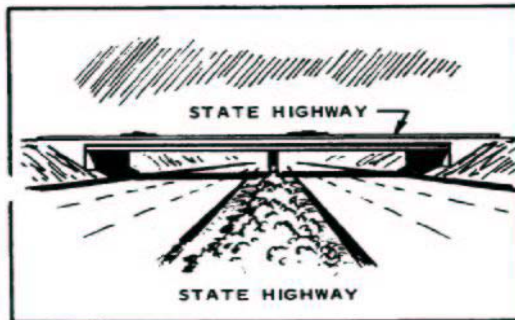
Naming conventions for structure types.  
For definitions see H.05 (C)



VIADUCT



VIADUCT



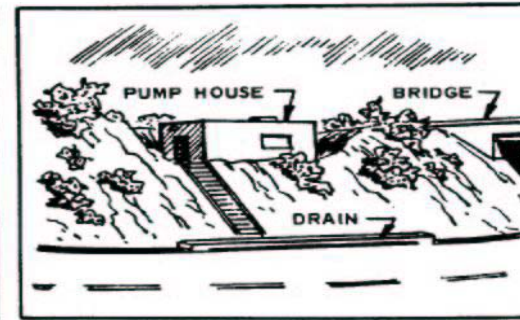
SEPARATION



TUNNEL

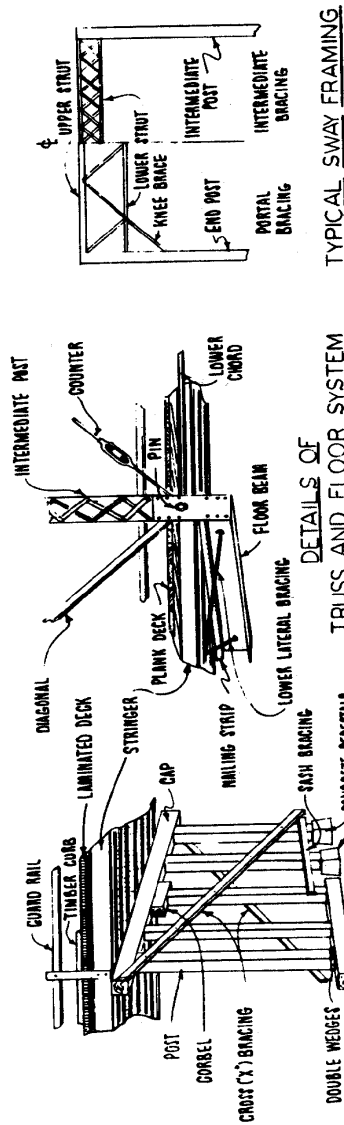
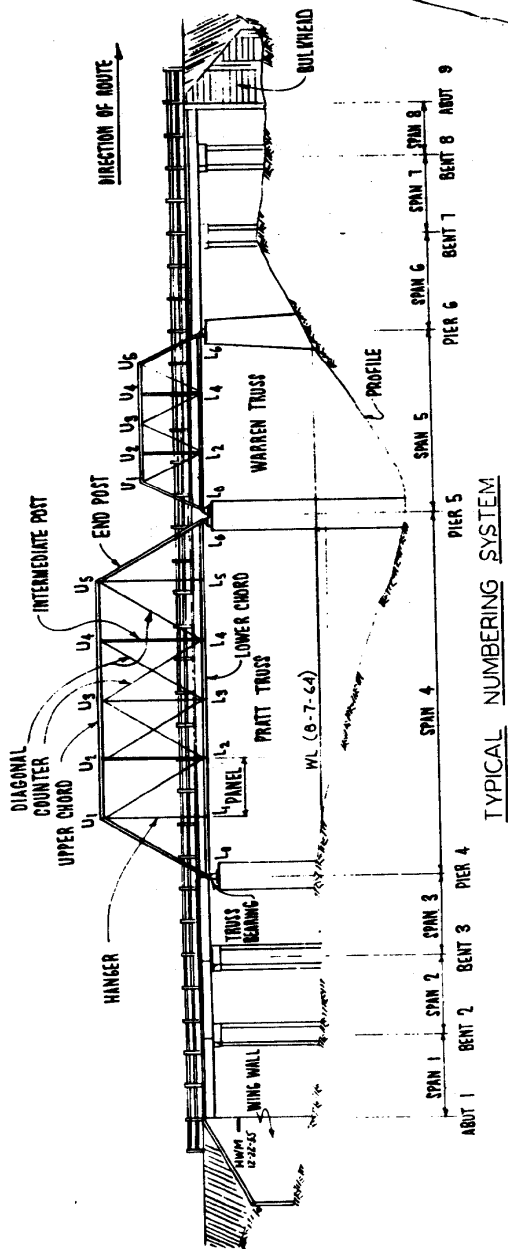


TUBE



PUMP









BRIDGES



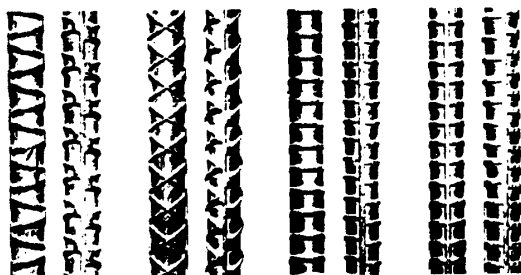
TYPICAL TIMBER BENT		TYPICAL SWAY FRAMING	
RC		W/S	
REINFORCED CONCRETE		WEARING SURFACE	
RW		WL	
REDWOOD		WATER LEVEL	
UF		HWM	
UNTREATED FIR		HIGH WATER MARK	
BTE		VC	
BROWN TREATED FIR (WOOD PRESERVATIVE)		VERTICAL CLEARANCE	
CDF		b/b	
CREOSOTED DOUGLAS FIR (PRESSURE TREATED)		DISTANCE BACK TO BACK	
		c/c	
		DISTANCE CENTER TO CENTER	

BRIDGES

REINFORCING STEEL BAR SIZES AND DIMENSIONS

REINFORCING STEEL					
STANDARD A305 REINFORCING BARS					
BAR SIZES		WEIGHT POUNDS PER FOOT	NOMINAL DIMENSIONS — ROUND SECTIONS		
OLD (INCHES)	NEW (NUMBERS)		DIAMETER INCHES	CROSS SECTIONAL AREA - SQ. INCHES	PERIMETER INCHES
	<b>2</b>	.167	.250	.05	.786
	<b>3</b>	.376	.375	.11	1.178
	<b>4</b>	.668	.500	.20	1.571
	<b>5</b>	1.043	.625	.31	1.963
	<b>6</b>	1.502	.750	.44	2.356
	<b>7</b>	2.044	.875	.60	2.749
<b>1</b>	<b>8</b>	2.670	1.000	.79	3.142
<b>1</b>	<b>9</b>	3.400	1.128	1.00	3.544
	<b>10</b>	4.303	1.270	1.27	3.990
	<b>11</b>	5.313	1.410	1.56	4.430
	<b>14</b>	7.650	1.692	2.25	5.316
	<b>18</b>	13.600	2.256	4.00	7.088

New Type Deformed Bars

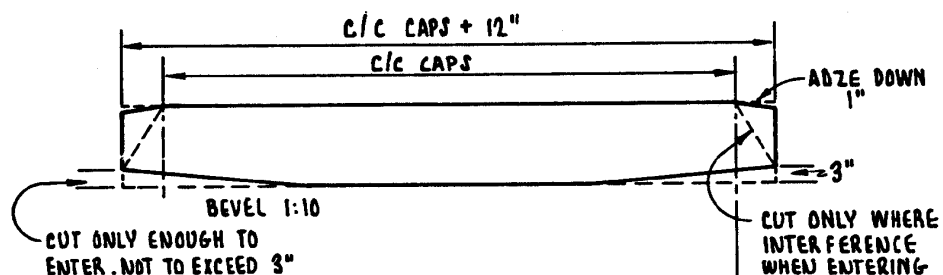


Old Type Deformed Bars

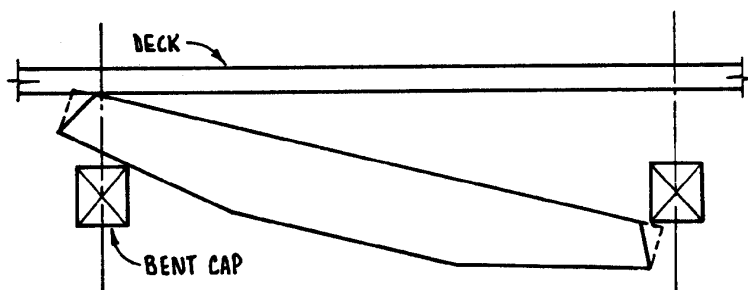


BRIDGES

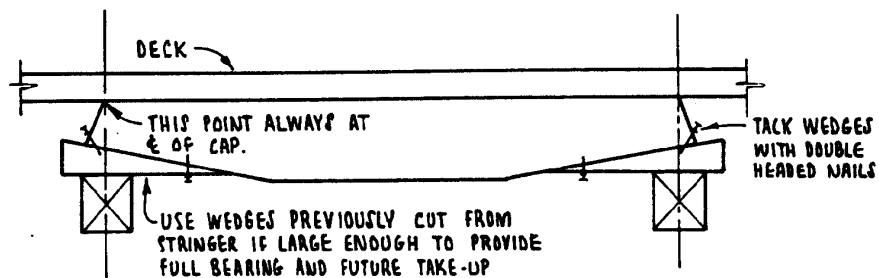
METHOD OF REPLACING EXISTING STRINGERS



CUTS TO BE MADE



ENTERING STRINGER



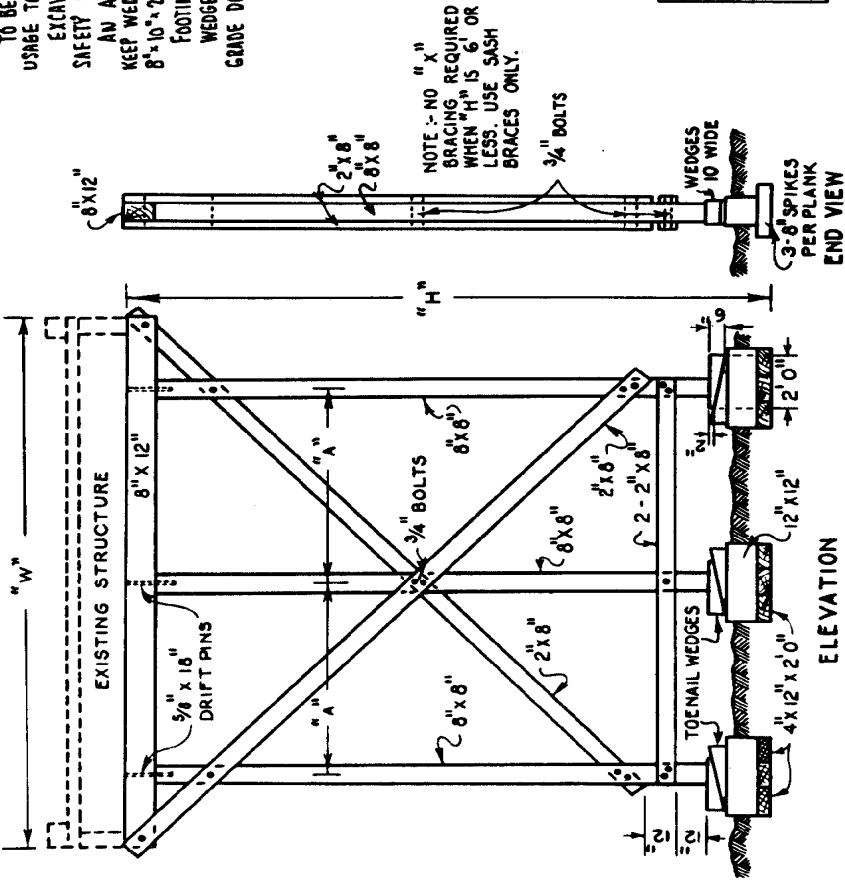
WEDGED IN PLACE

BRIDGES

DETAIL OF SUPPLEMENTAL TIMBER BENT

GENERAL NOTES

TO BE USED ONLY FOR REINFORCING EXISTING BRIDGES. LOCATION AND  
USAGE TO BE APPROVED BY THE BRIDGE DEPARTMENT.  
EXCAVATION TO BE CARRIED TO SUFFICIENT DEPTH TO PROVIDE  
SAFETY FROM SCOUR.  
AN ADDITIONAL 12-12" MAY BE PLACED ON FOOTING IF NECESSARY TO  
KEEP WEDGES ABOVE GROUND SURFACE. WEDGES TO BE CUT FROM  
8"x10"x2'-0" BLOCKS.  
FOOTING PLANKS AND BLOCKS TO BE HEART STRUCTURAL GRADE REDWOOD  
WEDGES AND OTHER TIMBER ABOVE GROUND SURFACE TO BE CONSTRUCTION  
GRADE DOUGLAS FIR.



TOTAL EQM IN STANDARD BENT					
HW	14	16	18	20	22
4	280	400	425	440	460
6	410	435	455	475	495
8	480	510	535	555	580
10	510	545	565	590	615
12	550	575	605	625	645
14	590	615	635	660	685
16	620	645	675	695	715
18	660	685	705	725	735
20	700	715	745	765	785

"W"	"A"
14'	5'-6"
16'	6'-6"
18'	7'-0"
20'	7'-6"
22'	8'-0"

HARDWARE IN ONE BENT		
QUANTITY	ITEM	WEIGHT LBS
3	5/8"x18" DRIFT PINS	4.7
8	3/4"x12" MACHINE BOLTS	23.2
7	3/4"x14" MACHINE BOLTS	4.0
50	3/4" MALLEABLE IRON WASHERS	10.0
	TOTAL	41.9

## STANDARD TIMBER GUARD RAIL AND WHEEL GUARD

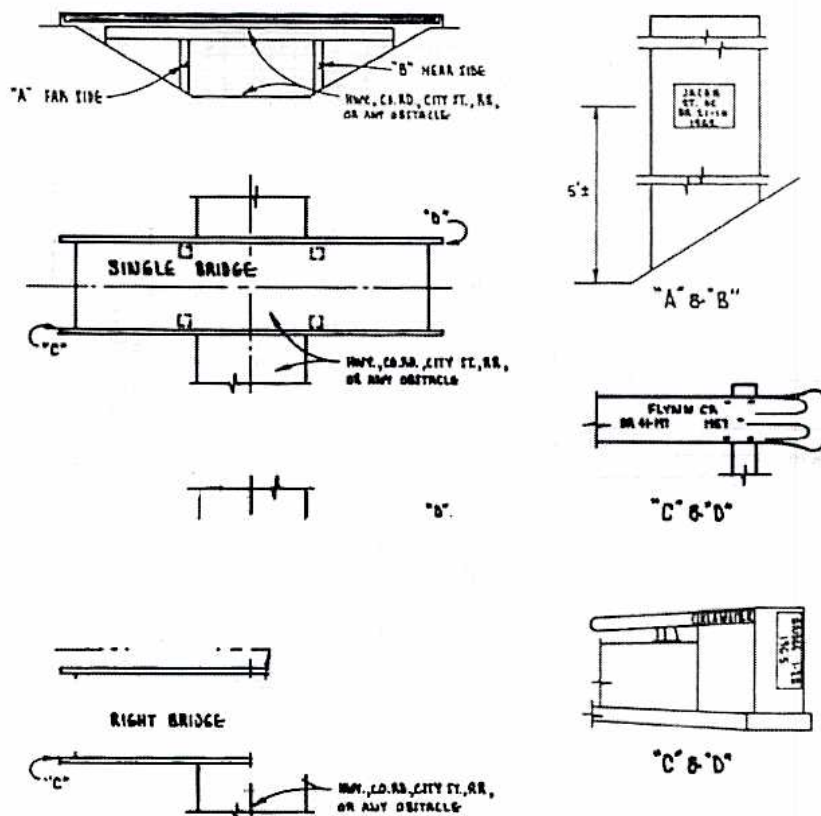
NOTE: ALL HARDWARE TO BE GALVANIZED  
ALL TIMBER TO BE HEART STRUCTURAL GRADE REDWOOD.

July 2006

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BRIDGES

NAME, BRIDGE NUMBER, YEAR BUILT ON STRUCTURES



LOCATIONS

TYPICAL DETAILS

STRUCTURE FUNCTION	DATA TO BE PLACED ON STRUCTURE		
	NAME	BRIDGE NO.	YEAR BUILT
HWY OVER STREAM	C, D	C, D	C, D
HWY OVER CO. RD	C, D	A, B, C, D	A, B, C, D
HWY OVER CITY ST	C, D	A, B, C, D	A, B, C, D
HWY OVER HWY	A, B, C, D	A, B, C, D	A, B, C, D
HWY OVER RR	C, D	C, D	C, D
HWY OVER OBSTACLE	C, D	C, D	C, D
RRY OVER CO. RD	A, B	A, B, C, D	A, B, C, D
RRY OVER CITY ST	A, B	A, B, C, D	A, B, C, D
RRY OVER RR	A, B	A, B	A, B
RRY OVER OBSTACLE	A, B	A, B	A, B

Appendix H-2

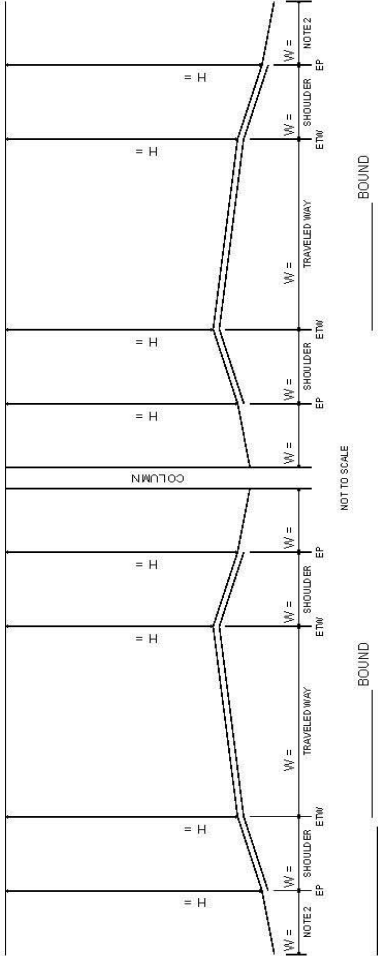
STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

NOTICE OF CHANGE IN CLEARANCE OR BRIDGE WEIGHT RATING

TR-0019 (NEW 6/2000)

BRIDGE NAME		BRIDGE NUMBER		DATE	
DISTRICT	COUNTY	ROUTE	PM	EA	CITY
SUBMITTED BY		PHONE NUMBER		FAX NUMBER	
TYPE OF CHANGE (SELECT ONE)		TENTATIVE START DATE		TENTATIVE END DATE	
<input type="checkbox"/> PERMANENT <input type="checkbox"/> TEMPORARY (SEE NOTE 1)					
BRIDGE WEIGHT RATING CHANGE (SELECT ONE)		EXISTING BRIDGE WEIGHT RATING		NEW BRIDGE WEIGHT RATING	
<input type="checkbox"/> YES <input type="checkbox"/> NO					

CLEARANCE DIAGRAM

BRIDGE NAME									
									
<div><div><input type="checkbox"/> K-RAIL (If Applicable) Move into Place</div><div><input type="checkbox"/> K-RAIL (If Applicable) Move into Place</div></div>									

- NOTES:
- 1) FOR TEMPORARY VERTICAL CLEARANCE CHANGES, DIMENSIONS ARE TO BOTTOM OF FALSEWORK
  - 2) INCLUDE DISTANCE TO ANY OBSTRUCTION (i.e. -GUARDRAIL, COLUMNS, K-RAIL)

FOR LIAISON USE ONLY:	
DATE RECEIVED BY LIAISON	DATE OF RCD/TRD CHANGE
LIAISON SIGNATURE	

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STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**NOTICE OF CHANGE IN CLEARANCE OR BRIDGE WEIGHT RATING**

TR-0029 (NEW 6/2000)

PLEASE FAX THIS FORM TO: NORTH REGION CONST/MAINT LIAISON (916-322-4957) FAX(916)-322-4081  
SOUTH REGION CONST/MAINT LIAISON (909-388-7077) FAX(909)-383-4296

BRIDGE NAME		BRIDGE NUMBER		DATE	
DISTRICT	COUNTY	ROUTE	PM	EA	CITY
SUBMITTED BY		PHONE NUMBER		FAX NUMBER	
TYPE OF CHANGE (SELECT ONE)		TENTATIVE START DATE		TENTATIVE END DATE	
<input type="checkbox"/> PERMANENT <input type="checkbox"/> TEMPORARY (SEE NOTE 1)					
BRIDGE WEIGHT RATING CHANGE (SELECT ONE)		EXISTING BRIDGE WEIGHT RATING		NEW BRIDGE WEIGHT RATING	
<input type="checkbox"/> YES <input type="checkbox"/> NO					

### CLEARANCE DIAGRAM

BRIDGE NAME \_\_\_\_\_

The diagram shows a cross-section of a bridge with two travel ways, shoulders, and notes. The left side is labeled 'LOOKING' and the right side is labeled 'ON'. The bridge is divided into sections by vertical lines. The leftmost section is labeled 'NOTE 2' and 'EP'. The next section is labeled 'SHOULDER' and 'W ='. The third section is labeled 'TRAVEL WAY' and 'W ='. The fourth section is labeled 'TRAVEL WAY' and 'W ='. The fifth section is labeled 'SHOULDER' and 'W ='. The rightmost section is labeled 'NOTE 2' and 'EP'. The bridge is shown with a dashed line representing the centerline. The bridge is labeled 'K-RAIL (If Applicable) Move into Place' at the bottom left.

NOT TO SCALE

LOOKING \_\_\_\_\_

ON \_\_\_\_\_

(DIRECTION)

NOTE 2

W =

EP

SHOULDER

W =

EP

TRAVEL WAY

W =

EP

TRAVEL WAY

W =

EP

SHOULDER

W =

EP

NOTE 2

W =

EP

NOTE 2

W =

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NOTE 2

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NOTE 2

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NOTE 2

W =

EP

## NOTES:

- 1) FOR TEMPORARY VERTICAL CLEARANCE CHANGES, DIMENSIONS ARE TO BOTTOM OF FALSEWORK
- 2) INCLUDE DISTANCE TO ANY OBSTRUCTION (i.e. - GUARDRAIL, COLUMNS, K-RAIL)
- 3) FOR DIVIDED HIGHWAYS, USE FORM NUMBER TR-0019

FOR LIAISON USE ONLY:

FOR LIAISON USE ONLY:	
DATE RECEIVED BY LIAISON	LIAISON SIGNATURE
DATE OF RCD/TRD CHANGE	

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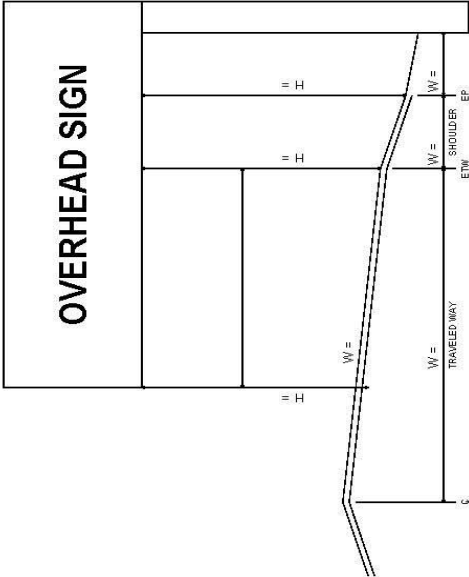
Appendix H-3

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**NOTICE OF CHANGE IN VERTICAL OR HORIZONTAL CLEARANCE**  
TR-0020 (NEW 6/2000)

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SOUTH REGION CONST/MAINT LIAISON (909-388-7077) FAX(909)-383-4296

SIGN NAME		SIGN NUMBER		DATE	
DISTRICT	COUNTY	ROUTE	PM	EA	CITY
SUBMITTED BY		PHONE NUMBER		FAX NUMBER	

CLEARANCE DIAGRAM



LOOKING (DIRECTION) ON (ROUTE)

☐ MAINLINE ☐ RAMP

FOR LIAISON USE ONLY: DATE RECEIVED BY LIAISON	DATE OF RCD/TRD CHANGE	LIAISON SIGNATURE
---	------------------------	-------------------

**ADA Notice** For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3880 or write Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814.

# **CHAPTER J1**

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J1.02.2	Tube and Tunnel Cleaning
J1.02	Tunnel and Tubes
J1.03	Ferryboats
J1.04	Pumping Plants
J1.04.1	Lubrication
J1.04.2	Electrical Equipment
J1.04.3	Data to be Posted
J1.04.4	Safety Procedures

Original signed by  
Barton Newton  
Assistant Division Chief,  
State Bridge Maintenance Engineer  
Division of Maintenance

## **J1.00 Introduction**

The Other Structures Program HM3J includes maintenance and repair of tunnels, tubes, ferries, and pumping plants. Tunnel or tube maintenance includes washing, cleaning, tile repair and the maintenance of electro-mechanical equipment. Tunnel structural repairs will be performed under this program when covered by approved Office of Structure Maintenance and Investigations reports of work needed. Ferryboat maintenance includes all work to maintain ferryboats and related facilities such as slips, fenders, and docks. Pumping plant maintenance includes structural repairs, removal of material from the sumps, and periodic servicing and/or repairs of all electrical and mechanical equipment.

See Chapter “H” for definitions and illustrations of tunnels, tubes, and pumping plants, and for the responsibilities of Area Bridge Maintenance Engineers and District Maintenance Engineers.

Refer to Maintenance Manual Volume 2 for administrative details covering the HM3J Program.

## **J1.01 Maintenance Levels**

The general objective is to maintain all facilities to their initial construction, or to subsequent improvement in order to ensure structural integrity, preserve the capital investment, aesthetics, and provide motorists a safe and comfortable passage.

Deficiencies that immediately affect safety and/or structural integrity should be given first priority.

Second priority should be given to correction of deficiencies not having an immediate effect on safety, structural integrity, or capital investment.

**J1.01.1      Tunnel, Tube, Ferry, and Pumping Plant Inspections**

Frequent visual surveillance should be made to detect deficiencies or conditions which may impair the structural integrity of tunnels, tubes, ferries, and pumping plants, or result in a hazard to traffic, pedestrians and adjacent property.

In addition to the physical inspection, an engineering investigation and evaluation of all tunnels, tubes, and ferries should be made by Structure Maintenance & Investigations (SM&I) a minimum of once every two (2) years. The Division of Engineering Services Office of Electrical, Mechanical, Water and Wastewater (OEMW&W) should make an engineering investigation and evaluation of pumping plant mechanical and electrical equipment at least once a year.

Investigations and evaluations should be comprehensive and include all portions of the facility. A written report should be made of all engineering evaluations on tunnels, tubes, ferries, and pumping plants.

First priority defects should be repaired promptly or temporary repairs made until permanent repairs can be scheduled.

Correction of second priority deficiencies should be coordinated with routine maintenance operations but initiation or scheduling of corrective action should not be delayed more than 30 days.

**J1.01.2      Tube and Tunnel Cleaning**

Tiled or painted tunnels or tubes should be cleaned a minimum of twice a year. Localized conditions such as high truck volumes may necessitate more frequent cleaning.

**J1.02      Tunnels and Tubes**

This section deals principally with tunnels and tubes incorporating mechanical ventilating systems that are staffed by full-time Tunnel Operators. It shall be the responsibility of the Superintendent to ensure that all Maintenance personnel are familiar with pertinent sections of Title 8 of the California Administrative Code covering orders issued by the Department of Industrial Relations (Cal/OSHA).

(A) Fire Alarm System

Where the tunnel fire alarm system is connected into the fire alarm system of another agency, no work shall be done upon the tunnel fire alarm system without notifying the other agency.

(B) Carbon Monoxide Analyzer Systems

The carbon monoxide analyzers shall be maintained and calibrated in accordance with instructions issued by the manufacturers of the analyzers.

(C) Electrical and Lighting Systems

Tunnel Maintenance Workers shall be familiar with the operation of all switches, breakers and other safety or operating equipment.

Repair or adjustment of electrical equipment shall be done by qualified electricians only. Permanent changes in the circuitry of the tunnels (tubes) shall not be made without consulting SM&I. This is not intended to prevent electricians from making necessary emergency connections.

(D) Fans, Motors, and Drives

Lubrication of bearings and machinery shall conform to requirements of Section J1.02.5, Lubrication.

Belt drives shall be adjusted in accordance with the recommendations of the belt manufacturers. When V-belt drives are replaced, they shall be replaced with matched sets of V-belts only.

(E) Lubrication

Standard items of manufacture such as electric motors, engines, compressors, gear reducers and pillow blocks incorporating sealed ball or roller bearings are usually furnished with Maintenance manuals that include recommended lubrication practices.

These practices shall be followed exactly unless overruled by "Specific Lubrication Instructions."

The manufacturer's manuals and the Specific Lubrication Instructions shall be made a part of the "Special or Supplemental Orders" included in data posted in each control room.

### **J1.03    Ferryboats**

Ferryboats shall be maintained in a serviceable condition and shall be the joint responsibility of District Maintenance, Office of Structure Maintenance and Investigations, and the Equipment Service Center. Every effort shall be made to keep ferries operational. Shutdowns for routine servicing and maintenance shall be scheduled during shifts of minimum vehicular use of the ferries.

The United States Coast Guard (USCG) does not currently inspect ferryboats, because no fee is charged to the public at the time of boarding. SM&I, in cooperation with the Equipment Service Center, will conduct biennial investigations and prepare engineering reports. Every effort shall be made by the district to provide service contracts to dry-dock the ferry on a 5 year cycle. This dry-dock service will allow for a complete hull inspection and repairs as required.

#### **(A)    Lubrication.**

Standard items of manufacture such as electric motors, engines, compressors, gear reducers and pillow blocks incorporating sealed ball or roller bearings are usually furnished with maintenance manuals that include recommended lubrication practices.

These manuals shall be made a part of the maintenance manual in the control room, and the recommended lubrication practices shall be followed exactly unless overruled by "Specific Lubrication Instructions."

Lubrication of open gears, wire ropes and sleeve bearings must be varied to meet the conditions under which they operate. Open gears seldom used and subject to accumulation of sand or dirt will be better protected and get less wear by painting with State Specifications 8010-61J-45 paint and leaving all oil or grease off the teeth.

Due to the great variation in proper lubrication requirements of somewhat similar facilities the proper practice for each ferryboat will be covered in Specific Lubrication Instructions.

The manufacturer's manuals and the Specific Lubrication Instructions for each ferryboat shall be made a part of the Special or Supplemental Orders included in data posted in each control room.

#### **(B)    Fire Protection.**

Fire extinguishing equipment shall be installed and maintained in accordance with requirements of the United States Coast Guard (USCG).

(C) Lifesaving Equipment.

Lifesaving equipment shall be installed and maintained in accordance with requirements of the USCG.

**J1.04    Pumping Plants**

Pumping plants shall be maintained in a clean and serviceable condition, and shall be inspected and the pumps manually operated at intervals frequent enough to ensure that the pumping equipment is in proper operating condition.

The building shall be kept swept out and generally cleaned up. Miscellaneous supplies and tools, other than those needed frequently for the pumping plant, shall not be stored in the pump building.

During the rainy season, the pumping plants should be inspected and test operated at least once every two (2) weeks. During the off season, the pumping plants shall be inspected and test operated at least monthly.

The test operation consists of operating each pump for approximately 5 seconds by switching the pump selector switch to the "HAND" or "MANUAL" position. Care shall be taken to ensure that the selector switches are reset to the "AUTO" position after each test so that the pump operation will be controlled by the water level in the storage box or pump sump.

During the rainy season, the sump screens shall be inspected regularly and kept free of all debris that will impede free flow of water to the pumps.

When large amounts of dirt or debris are entering the storage box or pump sump, due to erosion of cut slopes or to improperly screened catch basins, measures should be taken to stabilize the cut slopes and/or intercept the dirt or debris before it reaches the collection system.

Prior to each rainy season, each pumping plant shall be given a complete inspection, by an OMEW&W representative, and the supervisor who is charged with its maintenance.

Pump out fall facilities should be inspected and cleaned, if necessary to ensure a free flow of water beyond the pumping system.

During this annual inspection, the main power or control disconnect shall be opened and the electrodes removed from the stilling tube and cleaned if necessary. A brush and strong detergent solution is recommended for cleaning the electrodes. The connection of the suspender wires to the electrodes shall also be checked at this time for any corrosion at the connection, or of the suspender wire itself.

If the plant is equipped with a source of emergency power, it should be exercised at least bi-monthly. The most satisfactory method of testing the emergency power plant is to simulate water in the sump by grounding the electrodes and then simulating a power failure by opening the main power switch. After a successful start and test run of the emergency power plant and its associated controls, close the main power switch. If the plant goes through its normal shutdown procedure, return the plant to normal utility power.

These operational tests shall be made only by qualified personnel, either an electrician or pump maintenance personnel.

Dikes and other facilities installed to prevent the encroachment of off site drainage into the depressed area shall also be inspected and repaired if necessary.

#### J1.04.1        Lubrication

Pumping plants can be broken down into two (2) basic types: wet pit and dry pit. Each requires a different type of lubrication. In the wet pit, the pumps are submerged directly in the wet sump and are fitted with grease lubricated sleeve bearings. In the dry pit, the pumps are mounted in a dry sump with their suction lines connected to the wet sump through a dividing wall. These pumps are fitted with anti-friction type ball or roller bearings.

##### (A)    Wet Pit Style Pumps.

The column bearings are oil lubricated from a solenoid operated oil lubricator. The reservoirs shall be filled at all times with a non-detergent SAE 20 or SAE 30 weight oil.

The lubricators should release oil to each column bearing at the rate of 8-12 drops per minute.

During the rainy season, the pump bearings shall be greased approximately every 2 weeks or 2 hours of running time, whichever occurs first. During the off season, the pumps shall be greased bi-monthly (unless the pump is subjected to ground water or landscape watering run off, in which case it shall be greased on the same basis as for the rainy season).

**(B) Dry Pit Style Pumps.**

The dry pit pump is fitted with anti friction ball or roller bearings with grease retaining seals.

Because these bearings retain their grease supply and are not submerged in water, they do not require as frequent greasing as the wet pit pump bearings. Greasing of ball or roller bearings shall be limited to making up for the small amount of grease that may leak by the seals. If an abnormal amount of grease is observed leaking past the grease seals, the grease seal should be replaced.

If a dry pit is accidentally flooded, the pumps shall be shut down and the Area Bridge Maintenance Engineer or the OEMW&W representative assigned to the district notified immediately.

**(C) Motors.**

The electric motors are fitted with ball or roller bearings, some oil lubricated and others grease lubricated. It is very important that these bearings be lubricated in exact accordance with the maintenance instructions furnished with the motor.

**J1.04.2 Electrical Equipment**

Repair or adjustment of the electrical equipment shall be done by qualified electricians only.

Other Maintenance personnel charged with maintenance of pumping plants shall be made familiar with the switches and reset buttons that operate the plant but shall not be permitted to attempt repairs of the electrical equipment.

Permanent changes in the circuitry of the pumping plants shall not be made without consulting the Office of Structure Maintenance. This is not intended to prevent electricians from making necessary emergency connections.

The electrodes and float switches are set at certain elevations at the time of construction. No changes shall be made in these elevations without consulting the Office of Structure Maintenance.

**J1.04.3          Data to be Posted**

The following information shall be posted in each drainage-pumping plant. This means attaching to one wall in the pumping plant at a noticeable location, or placing in a clearly labeled binder or file:

- (A) Pump house Electrical Schematic.
- (B) Superintendent's name, address and telephone number.
- (C) Name and telephone number of Area Bridge Maintenance Engineer assigned to the district.

In addition to the above, a Pumping Plant Log (See page J-11) shall be mounted on a clipboard and hung on the wall where it will be very noticeable to anyone entering or leaving the pump house. Each time a Maintenance Worker enters a pumping plant, he or she shall record the visit in the log along with any work done during the visit. Most pumping plants have running time meters which record the accumulative running time of the pumps. It is very important that these times be recorded on every visit whether any work is done or not.

**J1.04.4          Safety Procedures**

Work in drainage pumping plants shall be done in accordance with all of the following:

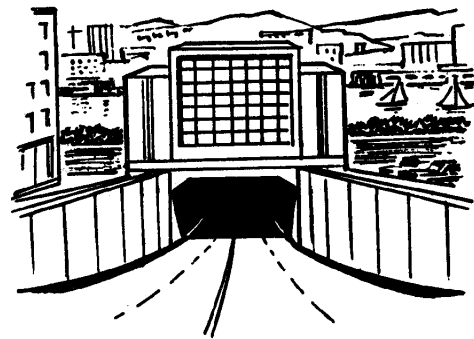
- (A) Article 108, General Industry Safety Orders, Title 8 California Administrative Code.
- (B) Caltrans Safety Manual, Chapter 2, Section 2-25: Confined Spaces.
- (C) All other instructions posted at the pumping plant.

**TUNNELS, TUBES, FERRIES, AND PUMPING PLANTS**



**TUNNEL**

**TUNNEL**—This term is used in the name of a passageway which carries State Highway traffic underground such as through a hill or mountain.



**TUBE**

**TUBE**—This term is used in the name of a passageway which carries State Highway traffic below or under a body of water.

## TUNNELS, TUBES, FERRIES, AND PUMPING PLANTS

[illegible]

## TUNNELS, TUBES, FERRIES, AND PUMPING PLANTS

DEPARTMENT OF TRANSPORTATION  
GENERATOR LOG-CHECK LIST

CHC NUMBER

## HOME BASE

**DS-00031-1/90**

### INSTRUCTIONS

WHEN SHEET IS FULL: ROUTE ORIGINAL TO REGION OFFICE, SECOND COPY TO ELECTRICAL REGION OFFICE AND THIRD COPY TO CLIPBOARD WITH GENERATOR. CHECK PURPOSE OF VST. IF SERVICE NEEDED BEYOND YOUR ABILITY, ADVISE YOUR SUPERVISOR. PLACE YES, NO, OR ✓ MARK IN EACH COLUMN AS APPROPRIATE.

# CHAPTER J2

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J2.00.1	Public Contact
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J2.01.2	Data to be Posted
J2.01.3	Duties of Drawbridge Operators
J2.02	Tunnel and Tube Operations
J2.02.1	Data to be Posted
J2.02.2	Duties of Tunnel and Tube Operators
J2.03	Ferry Operations
J2.03.1	Rules and Regulations
J2.03.2	Duties to be Posted
J2.03.3	Duties of Ferry Operators
J2.04	Toll Collection Systems

Original signed by  
Barton Newton  
Assistant Division Chief,  
State Bridge Maintenance Engineer  
Division of Maintenance

## **J2.00 Introduction**

This chapter contains information relevant to the Highway Operations Program HM46.

The goal of the Highway Operation Program is to provide appropriate levels of transportation service on the existing highway system through the operation of roadway facilities such as drawbridges, ferries, tubes and tunnels. These facilities have been provided by previous improvement programs and are operated under this program. This program also provides electricity required to energize overhead lights, signals, and all other electrical facilities.

Refer to Maintenance Manual Volume 2 for administrative details covering this program.

### **J2.00.1 Public Contact**

Operators of the drawbridges, tunnels, tubes, and ferries have frequent contact with the public.

Maintenance personnel shall remember at all times that they are representatives of Caltrans.

They should perform their duties quickly and with courtesy.

Such employees shall under no circumstance engage in any argument. Any criticism of highway matters, or any request for information which, cannot be readily answered or supplied, are to be referred to the employee's supervisor.

## **J2.01 Drawbridge Operations**

Drawbridges shall be maintained in a serviceable condition and shall be operated at intervals frequent enough to make certain that the machinery is in proper operating condition.

When an opening is made, the drawbridge shall be fully opened to preclude the possibility of collision between vessels and the moveable spans.

### **J2.01.1 Rules and Regulations**

All drawbridges shall be operated in accordance with the "California Drawbridge Regulations (1986)" issued by the United States Coast Guard and such other instructions as may be issued by the Department of Transportation.

Bridges must have navigational lights in accordance with Title 33, part 68 of the Code of Federal Regulations.

Bridges presenting obstructions to air navigation are lighted in accordance with the requirements of "Obstruction Marking and Lighting" as issued by the Federal Aviation Agency. All personnel charged with the operation of drawbridges shall be familiar with their duties and responsibilities under these regulations. Visitors will be allowed only with prior approval of the supervisor of this facility. Visits shall be kept brief and occasional.

**J2.01.2          Data to be Posted**

One copy of each of the following shall be posted inside each drawbridge control house. By posting it, is meant to attach to one wall of the control room in a noticeable location or placing in a clearly labeled binder or file.

- (A) Maintenance Manual Volume 1.
- (B) "California Drawbridge Regulations (1986)" issued by the United States Coast Guard.
- (C) "Aids to Navigation" CG-208, U.S. Coast Guard. The U.S. Coast Guard no longer updates this publication, but the information pertaining to the navigation lights is still valid.
- (D) A separate listing of the boat signals for the particular bridge.
- (E) "General Operating Instructions" posted in a prominent location near the controls.
- (F) Special or supplemental orders or maintenance manuals which apply to the particular bridge.
- (G) "Obstruction Marking and Lighting", Federal Aviation Agency (only at bridges where air navigation lights are installed).
- (H) Print of the schematic wiring diagram if the bridge is electrically operated.
- (I) Superintendent's name, address, and telephone number.
- (J) Name and telephone number of the Area Bridge Maintenance Engineer (ABME) assigned to the district.

**J2.01.3          Duties of Drawbridge Operators**

It shall be the duty of the drawbridge operator to operate the bridge in accordance with Section J2.01.1 "Rules and Regulations". The drawbridge operator shall be familiar with the operation of all switches, breakers and other safety or operating equipment and he or she shall keep a daily log showing all operating information.

A special report shall be made of accidents, either involving the public or the equipment, which occur within the area of duty. The operator shall also make such reports as are required by the United States Coast Guard.

All special reports shall be forwarded to the drawbridge operator's supervisor, who in turn shall forward them to the district office. Reports shall be available for use by the Legal Service Center, without alteration, but accompanied by such recommendation or comment as the matter justifies, so that all matters, particularly repairs, will receive attention by the proper parties without unnecessary delay. Copies of these reports shall also be forwarded to the ABME assigned to the district.

Whenever operating difficulties or conditions that require early attention are encountered, the drawbridge operator shall immediately report the full details to the supervisor. Any verbal report must be confirmed in writing. In order to have definite records available at the bridge for the information of inspectors or repair crews, drawbridge operators shall be provided with a bound memorandum book and shall list in this book a record of all difficulties experienced in the handling of the bridge. The records will be of sufficient detail to aid in tracing the trouble. The books will be kept in the bridge control house.

Matters of importance shall be reported immediately by telephone, radio or messenger. If contact cannot be made with the supervisor or Superintendent, the appropriate ABME with Structure Maintenance and Investigations (SM&I) shall be called.

The drawbridge operator shall be thoroughly familiar with emergency operating procedures especially the use of the bypass switches.

The drawbridge operator shall also be responsible for policing the control house and the immediate area of the bridge. Burned out lamps shall be replaced and light fixtures and windows shall be kept clean.

Particular attention shall be given to the maintenance of the navigation lights. Grease and oil shall be cleaned up. Newspapers, magazines and other trash shall not be allowed to accumulate.

The drawbridge operator is responsible for all operations within the hours of their assigned shift, for any articles brought into the control house that may cause a distraction from their assigned duties. The drawbridge operator is not to relinquish control of the drawbridge to the next shifts' operator if it is obvious that the relieving operator will not be able to fully perform the required duties. If this happens, the supervisor must be immediately notified of the situation. If there is any reason to question the relieving operators' ability to perform his or her duties, the supervisor should be notified of the situation.

All consideration for safety must be observed. Before opening the bridge, the drawbridge operator shall thoroughly check that all pedestrians or vehicles are safely behind the provided barriers and that the movable portions of the bridge are free of vehicles and pedestrians. Upon arrival on shift, the operator is required to follow the pre-operational checklist to ensure safe operation of the structure.

## **J2.02 Tunnel and Tube Operations**

### **J2.02.1 Data to be Posted**

One copy of each of the following shall be posted in each tunnel (tube) control room. By posting, it is meant to attach to one wall of the control room in a noticeable location, or placing in a clearly labeled binder or file.

- (A) Maintenance Manual Volume 1.
- (B) Special supplemental orders or manuals that apply to the particular tunnel (tube), including all wiring diagrams.
- (C) Instructions covering the operator's duties in case of fire in or about the tunnel (tube).
- (D) Superintendent's name, address and telephone number.
- (E) Name and telephone number of the ABME assigned to the district.

### **J2.02.2 Duties of Tunnel and Tube Operators**

Operators shall operate the tunnel (tube) operating system consisting of the ventilating fans and drives, electrical and lighting systems, the carbon monoxide analyzer systems, telephone and fire alarm systems and other auxiliary equipment.

A bound logbook shall be provided in the control room of each tunnel (tube). The operators shall keep a record of all events affecting the operation of the tunnel (tube) in the logbook. All operating difficulties shall be recorded in the logbook; however, the details of the difficulty shall be recorded in the bound memorandum book mentioned later in this section.

A special report shall be made of accidents, either involving the public or the equipment, which occur within the area of duty. All reports shall be made in triplicate. One copy shall be placed in a binder provided for that purpose and retained at the tunnel (tube) and one copy forwarded to the Area Bridge Maintenance Engineer. The original shall be forwarded to the operator's supervisor, who in turn shall forward it to the district office without alteration.

The reports will be accompanied by such recommendations or comments as the matter justifies, so that all matters, particularly repairs, will receive attention by the proper parties without unnecessary delay.

Whenever operating difficulties or conditions that require early attention are encountered, the operator shall immediately report the full details to the supervisor. Any verbal report must be confirmed in writing. In order to have definite records available at the tunnel (tube) for the information of inspectors or repair crews, operators shall be provided with a bound memorandum book and shall list in this book a record of all difficulties experienced in the operating system.

Records will be of sufficient detail to aid in tracing the trouble. The books will be kept in the control room.

Matters of importance shall be reported immediately by telephone, radio or messenger. If contact cannot be made with the Superintendent or the district office, the ABME assigned to the district should be called.

The operator shall be responsible for policing the control room, fan rooms, and other areas in and about the tunnel. Burned out lamps shall be replaced and light fixtures and windows shall be kept clean. Grease and oil shall be cleaned up. Newspapers, magazines and other trash shall not be allowed to accumulate.

The operator is also responsible for all operations within the hours of their assigned shift: their relief, being capable of performing the tasks required, any articles brought into the control room that will cause a distraction from their assigned duties, and for shift changes being made as scheduled.

### **J2.03 Ferry Operations**

#### **J2.03.1 Rules and Regulations**

All ferryboats shall be operated in accordance with "Rules and Regulations for Small Passenger Vessels" CG-323, as issued by the United States Coast Guard and such other instructions as may be issued by the Department of Transportation.

#### **J2.03.2 Data to Be Posted**

One copy of each of the following shall be posted in the operator's quarters on each ferryboat.

By posting it is meant to attach to one wall of the control house in a noticeable location or placing in a clearly labeled binder or file.

- (A) This Maintenance Manual.
- (B) Special, or supplemental orders, or manuals, which apply to the particular ferry.
- (C) Instructions covering the operator's duties in case of fire in or about the ferry.
- (D) Superintendent's name, address and telephone number.
- (E) Name and telephone number of the ABME assigned to the District.

#### **J2.03.3 Duties of Ferry Operators (Masters, Mates and Deckhands)**

It shall be the duty of the Ferry Operator to operate the ferry in accordance with Section J2.03.1 "Rules and Regulations." He or she shall inspect the cable on cable operated ferries each shift.

The Ferry Operator shall keep a daily log showing all operating information and conditions warranting attention. A special report shall be made concerning all accidents, involving either the public or the equipment, which occur within the area of duty. He or she shall also make all reports required by the U.S. Coast Guard or other agencies. All reports shall be forwarded to the Ferry Operator's supervisor, who in turn shall forward it to the district office. At the district office, it will be available for use by the Legal Service Center, without alteration, but accompanied by such recommendations or comments as the matter justifies, so that all matters, particularly repairs, will receive attention by the proper parties, without unnecessary delay. A copy of damage reports shall also be forwarded to the ABME.

Whenever operating difficulties or conditions that require early attention are encountered, the Ferry Operator shall immediately report the full details to his or her supervisor. Any verbal report must be confirmed in writing. In order to have definite records available at the ferry for the information of inspectors or repair crews, Ferry Operators shall be provided with a bound memorandum book, and shall list in this book a record of all difficulties experienced in the handling of the ferry. Records will be of sufficient detail to aid in tracing the trouble. The books will be kept in the ferry control house at all times.

Upon arrival on shift, the Ferry Operator is required to perform the pre-operational checklist to insure safe operation of the ferryboat.

Matters of importance shall be reported immediately by telephone, radio or messenger. If contact cannot be made with the supervisor or Superintendent, the ABME assigned to the district should be called.

The Ferry Operator shall adhere to operating regulations, make every effort to avoid mistakes in operation, and give every consideration to safety. The Ferry Operator is responsible for all operations within the hours of their assigned shift, and for any articles brought into the ferry control house that will cause a distraction from their assigned duties. Failure to fulfill these obligations may result in serious accidents.

Ferry Operators must not permit vehicles to leave the ferry until the apron is fully down and making positive contact with the ferry slip. If the ferry is shut down or left unattended for any reason, it shall be securely attached to the slip to prevent it from drifting away from shore. Additionally, it is the responsibility of the Ferryboat Operator to not allow vehicles on the ferry that exceed the posted loads and axle configurations.

The Ferry Operator is not to relinquish control of the ferryboat to the next shift Ferry Operator if it is obvious that the relieving Ferry Operator will not be able to fully perform their required duties. If this happens, the supervisor must be immediately notified of the situation. If there is any reason to question the relieving Ferry Operators' ability to perform his or her duties, the supervisor should be informed of the situation.

#### **J2.04 Toll Collection Systems**

Periodic inspections of toll bridge electrical systems listed below are essential to observe and correct potential deficiencies before serious problems develop.

**(A) Auto Call System**

- (1) Check and test monthly.
- (2) Service transmitters quarterly.

**(B) Toll Collection System**

- (1) Monthly checks and service on the mainframe as recommended by the manufacturer.
- (2) Replace the absolute and pre-filter units every three (3) months and log record of maintenance.

**(C) Lane Console**

- (1) Check backup tapes weekly. Replace if required.
- (2) Perform monthly preventive maintenance on the operator's control panel and processor section.
- (3) Replace filter every 30 days and vacuum dust from inside the console assembly.
- (4) Complete lane maintenance procedure to be accomplished at least once a year including cleaning of electronic board contacts.

The following items are part of the bridge structure (H Family), and should be charged/coded appropriately:

- (A) High Voltage Power Distribution Switch Gear and Cables.
- (B) Fire and Security System.
- (C) Bridge Air Supply System.
- (D) Fire Hydrant Booster Pumps.
- (E) Standby Emergency Power Systems.

In addition, traffic metering systems that are located at toll plazas are part of K.06 – Freeway Meter Signals, and should be charged/coded appropriately.

# **CHAPTER K**

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## **K.00 Introduction**

This chapter includes all work performed on highway electrical facilities used for control of traffic with traffic signal systems, highway and sign lighting systems, Traffic Management System (TMS) Field Elements, Intelligent Transportation Systems (ITS), count stations, and other related systems.

The general objective of this program is to maintain all highway electrical facilities described above to ensure reliable electrical systems and service.

The Division of Maintenance or the district Electrical Maintenance unit will not affect any permanent changes or modifications that will change the operational characteristics of an electrical facility without prior approval in writing from the Division of Traffic Operations, the District Traffic Operations unit, or other appropriate Department Branch.

Damaged or malfunctioning electrical installations, which seriously affect public safety, or capital investment, should be highest priority in Electrical Maintenance for repair or temporary corrections until permanent repairs can be scheduled. Lower priority should be given to repair of inoperative or damaged electrical installations, which do not seriously affect public safety.

Refer to Maintenance Manual Volume 2, for administrative details and charging/coding practices for the "K" Family.

## **K.01 Levels of Service**

Refer to Maintenance Manual Volume 2, for Levels of Service regarding the "K" Family.

## **K.02 Highway Lighting and Sign Illumination**

Highway lighting and sign illumination is provided to improve visibility during darkness, and to promote safe and efficient use of special roadway facilities.

Maintenance of highway lighting and sign illumination is the preservation of the facility in the safe and usable condition to which it has been improved or constructed.

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**K.02.1 Night Lighting Inspection**

Highway lighting and sign illumination should be inspected at night for proper operation once each month. Electrical Outage Worksheets, or some other recording device, should be used to list each outage by county, route, post mile, and pole number. Knocked down lighting standards and illuminated street name sign outages should also be recorded on this form.

The most recent Electrical Outage Worksheet or other record shall be kept on file at the crew supervisor's office.

Information from the recent Electrical Outage Worksheet or other record shall be entered into IMMS in a timely manner as directed by region policy. It is suggested that this be accomplished within one (1) week of the night lighting inspection.

**K.02.2 Luminaires**

Luminaires should be thoroughly inspected at the time of lamp replacement. These inspections should include the following items as a minimum:

- (A) Gaskets : Inspect for loose or missing gasket; repair or replace as required.
- (B) Glassware : Inspect for cracked or broken glassware; replace if necessary.
- (C) Hardware : Apply suitable thread lubricant to hardware item which must be removed in the course of routine maintenance.
- (D) Terminal Block : Inspect for cracked or broken barriers on the block; replace if necessary.
- (E) Mounting : Inspect to determine if luminaire is rigidly held in proper position; make any necessary adjustments.
- (F) Sockets and Receptacles : Inspect for burned current carrying parts and broken insulation; replace if necessary.
- (G) Wiring : Inspect for abrasions that might develop shorts or grounds, and repair as required.
- (H) Reflectors : Inspect for scum or tarnish; replace if necessary.

**K.02.3          Photoelectric Controls**

Photoelectric controls should be checked during routine lighting inspection and serviced periodically or replaced as required.

Attention should be given to coordinating controls to ensure that all highway lighting units turn off or on at approximately the same time within an interchange or closely spaced interchanges.

Circuits designed for early turn on of illuminated signs should have the early turn on type of photocells. When these photocells fail, it is important that they are replaced with the correct unit. See Standard Specifications for correct turn off and turn on settings.

**K.02.4          Luminaire Ballast Fusing**

Where primary lines of multiple ballasts are provided with fused splice connectors, fuse ratings should be as shown on the Standard Plans.

**K.02.5          Relamping**

Lamp outages noted on the monthly night lighting inspection should be scheduled for replacement as soon as workload permits.

All lamps should be group replaced on a planned schedule based on the rated lamp life, which is published by the manufacturer. Lamp life is based on life tests of the particular lamp operated at rated voltage and current. Group replacement has several advantages. It reduces the frequency of outages, thereby lowering the cost of maintenance, and illumination is kept to nominal levels.

Typical group relamping schedules based on current rated life are as follows:

- |                             |                             |
|-----------------------------|-----------------------------|
| (A) Fluorescent (inductive) | Group relamp every 12 years |
| (B) Mercury                 | Group relamp every 4 years  |
| (C) High Pressure Sodium    | Group relamp every 4 years  |
| (D) Low Pressure Sodium     | Group relamp every 3 years  |
| (E) Fluorescent (tube)      | Group relamp every 2 years  |

Accurate records should be kept indicating group relamping dates and location.

**K.02.6            Sign Lighting Fixtures**

It is the Department's policy to only illuminate those signs that it deems necessary. When maintaining a dark sign lighting fixture, consult with the Division of Traffic Operations or the District Traffic Operations unit to insure that the sign is being illuminated according to policy. Malfunctioning fluorescent (tube) sign lighting fixtures should be replaced with mercury or fluorescent (inductive) sign lighting fixtures, or removed, provided the Division of Traffic Operations or District Traffic Operations unit concurs.

Use fixtures specified in the Standard Specifications and use fixture spacing charts as shown in the Standard Plans.

With this change, relamping will be extended from 2 years to 4 years, or 12 years.

**K.02.07            Lighting Standards and Mast Arms**

Lighting Standards and mast arms should be inspected periodically for loose bolts and nuts. The inspection period should be the same as the relamping period at the minimum, or more often as outage repairs are performed.

Missing hand hole covers should be noted during monthly inspections, and replaced as soon as practical and work load permits.

Lighting standards with slip bases or slip base inserts should be inspected periodically to ensure the slip bases or slip base inserts will function properly under the impact of collision.

In particular, attention should be given to:

- (A) Soil erosion, damage, or dirt build-up around the pullboxes or foundations of the standards.
- (B) Excessive growth of grasses or bushes near the pullboxes or standards.
- (C) Any obstacles that will interfere with the operation of the slip bases or slip base inserts.

**K.02.8 High Mast Lighting**

In addition to the steps outlined in the previous paragraphs, special maintenance procedures have to be followed when working with high mast equipment. These procedures deal primarily with the design of the mechanical hoisting mechanism components, which provide for the luminaires to be lowered and raised. Manufacturers of high mast equipment use different designs, so only general maintenance recommendations applicable for all types of equipment can be given. To assure the proper, long, and trouble-free life of the equipment, follow the steps outlined in the manufacturer's maintenance literature closely.

Listed below are steps of a general nature, which serve as a general overview of Maintenance requirements, which should be accomplished :

**(A) Winch**

- (1) Remove any dirt or foreign debris which may have accumulated on top of the winch or on the wire cables and clean thoroughly.
- (2) Check oil in oil bath, and add or change if excessively thick and/or dirty.
- (3) Check all bearings and lubricate if required.
- (4) Operate the lowering device through its full length of travel and visually inspect for undue wear on the winch mechanism.

**(B) Cables**

- (1) Inspect the cable lay on the winch and the section of cable visible at mast door opening for frays, kinks, or corrosion.
- (2) Inspect winch cable throughout its length for frays, kinks, or corrosion.
- (3) Inspect anchorage points of winch cable on winch and of hoisting cables at luminaire supporting ring.
- (4) From the base of the mast, observe hoisting cables from luminaire support ring in lowered position to masthead for any obvious defects.

**(C) Luminaire Ring**

The Luminaire Ring should be lowered approximately every 6 months and inspect the following:

- (1) While lowering the ring, make sure the roller contacts of the centering arms are in contact with the pole throughout the entire length of travel.
- (2) Inspect the spring of the centering arms for corrosion, clean and lubricate if required.
- (3) Inspect guide rollers (where fitted) and lubricate and adjust as necessary.
- (4) Inspect interconnecting cables and junction boxes for damage and repair as necessary.
- (5) Inspect electric power supply cable anchorage, sockets, and connectors, and inspect cable for physical damage.
- (6) Inspect and tighten all nuts and bolts if necessary.

**(D) Foundation Bolts**

- (1) Check foundation bolts, and tighten nuts where necessary.

**K.03 Toll Collection Systems**

Toll Collection Systems are now covered under Chapter “J2” of this manual.

Traffic metering systems that are located at toll plazas are part of K.06 – Freeway Meter Signals, and should be charged/coded appropriately.

## **K.04 Traffic Signals**

Traffic control signals are power-operated traffic control devices, which alternately direct traffic to stop and to proceed at highway and street intersections. Their purpose is the orderly assignment of right of way to the various traffic movements.

### **K.04.1 Legal Authority**

Section 21350 of the Vehicle code authorizes the Department of Transportation to place and maintain appropriate signs, signals and other traffic control devices as required to warn or guide traffic upon the highways. A permit is required for the erection by others of traffic signals and flashing beacons, on all State highways, whether within incorporated or unincorporated areas.

### **K.04.2 Traffic Signal Timing and Operations**

Initial timing of traffic signals and any subsequent changes in timing shall be the responsibility of the Division of Traffic Operations or the district traffic signals operation unit. Maintaining the timing is the responsibility of the Division of Maintenance or the district Electrical Maintenance unit. Temporary timing changes can be made by the Division of Maintenance or the district Electrical Maintenance unit to compensate for sudden changes in traffic conditions or malfunctioning traffic signal equipment that cannot be repaired or replaced immediately. Any temporary changes to the signal timing shall be noted in the traffic signal cabinet and the Division of Traffic Operations or the district traffic signals operation unit must be notified of any temporary timing changes as soon as possible. Signal Timing Forms will be prepared and furnished by the Division of Traffic Operations or the district traffic signals operation unit, and a copy sent to the Division of Maintenance or the district Electrical Maintenance unit. Signal timing records should be kept by both the Division of Traffic Operations or the district traffic signals operation unit, and the Division of Maintenance or the district Electrical Maintenance unit.

Any observed timing or operational traffic signal problems should be promptly reported to the Division of Traffic Operations or the district traffic signals operation unit.

The standard traffic signal program at the time of this Manual's revision is C8 v 4. This will change from time to time when improvements are made on the software. When replacing a 170 controller, contact the district traffic signal operations unit to request authorization to install the current standard signal software, and the timing parameters.

**K.04.3          Traffic Signal Records**

Adequate office records are a necessary function of the signal maintenance organization.

Office records should include the following types of statistical data:

- (A) Type and number of traffic signals.
- (B) Lighting equipment at each location.
- (C) Date of installation.
- (D) Type and date of all trouble calls.
- (E) Who reported the trouble.
- (F) Who repaired, and extent of the repairs.

The Division of Traffic Operations or the district traffic signals operation unit, which approves signal installations and generally prepares the specifications, would like to be informed on any operating difficulties encountered with any type of equipment or equipment from a particular manufacturer. With this information, they can change or revise the specifications on some types of equipment to eliminate any defects or eliminate use of equipment from that manufacturer.

**K.04.4          Maintenance of Traffic Signals**

A detailed check should be at 90 day intervals for proper operation of controller assemblies and signals. This check should include the following items as a minimum:

**(A) Field Inspection**

- (1) Visual check of indications.
- (2) Vehicle and pedestrian head alignment.
- (3) Pushbutton operation.
- (4) Hardware (hand-hole covers, signs, poles, backplates, etc.).
- (5) Pullbox covers (broken, missing, and clear of dirt or debris).
- (6) Condition of street name signs.
- (7) Visual check of service cabinet and equipment locks.
- (8) Traffic handling of intersection.
- (9) Visual check of loops in roadway.

**(B) Cabinet Interior**

- (1) Controller unit indicator lights.
- (2) Function and timing.
- (3) Detector indicator lights.
- (4) Check flasher outputs.
- (5) Check and adjust contacts.
- (6) Check monitor indicator lights.
- (7) Isolator function and operation.
- (8) Thermostat and ventilation system including filter.
- (9) Clean cabinet and interior components.
- (10) Check documentation. (timing sheets, schematics, wiring plans, etc., and inspection noted on cabinet login card).

**(C) Cabinet Exterior**

- (1) Condition of surface (paint, damage and graffiti).
- (2) Condition of locks and handles.

**(D) Battery Backup System (BBS)**

- (1) Check physical condition of batteries, cables and connections.
- (2) Check battery level.
- (3) Test operation of BBS.
- (4) Note use indicators.

**K.04.5 Maintenance of Electrical and Electronic Modular Components**

This section outlines the procedures for the maintenance and repair of electrical and electronic modular components associated with traffic signals, flashers, ramp meters, CCTV, CMS, and other relevant field assets. It also details the roles and responsibilities of the three Central Repair Shops and the District Electrical Maintenance crews. For this document, the term modular component is defined as follows:

Any device to include but not limited to; 170 controllers, 2070 controllers, conflict monitors, detector cards, isolation cards, CMS components, CCTV components, or any other device that has circuit board technology and requires bench level diagnostics; repair and replacement of individual electronic components.

**CENTRAL REPAIR SHOPS**

- (A) All circuit board level repairs on electrical and electronic modular components will be performed at one of the three Central Repair Shops located at District 3, District 4, and District 7. District 3 will provide service to Districts 1, 2, and 10; District 4 will provide service to Districts 5 and 6; District 7 will provide service to Districts 8, 9, 11 and 12.
- (B) Defective modular components will be sent to the assigned Central Repair Shop for diagnostics and repairs. The Central Repair Shop will make a determination as to if a board or unit should be repaired or salvaged dependent on initial cost, cost of repair, and age.
- (C) The three Central Repair Shops (D3, D4, and D7) shall no longer perform repairs on the following components:
  - Model 200 Switch Packs
  - Model 204 Flashers
  - Model 208 Monitor Unit
  - Model 222 Detector
  - Model 224 Detector
  - Model 242 DC Isolators
  - Model 252 AC Isolators
  - Model 252R AC Isolator
- (D) The Central Repair Shops can repair other components not listed in (C) above, provided that the total costs of repairs (including all history) do not exceed the set salvage point for that type of component.

- (E) The Central Repair Shops shall follow the approved guidelines as to when a component **must** be salvaged and replaced with a new unit.
- (F) The Central Shops will not perform repairs on components that are obsolete or beyond the point of economical repair. If the cost of a single repair to a component exceeds the set point of salvage, the repairs will not be performed, regardless of the type of component. The cost of repairs should also include any past costs as well as consideration for the type of problem and reoccurrence of similar problems. An exception would be made for components that have no replacement available.
- (G) If the Central Repair Shop receives a component from a district that is beyond economical repair, the component is to be salvaged in the Central Repair Shop (not returned to the district). The district should be notified of salvages so they can order replacements.
- (H) The Central Repair Shops will retain repair history for larger dollar components (170, 210, CIA, cameras, etc.). These history records will be reviewed prior to performing repairs on the component. If the cost of past repairs is approaching the point of salvage, then the unit will be salvaged.
- (I) The Central Repair Shops will track the salvage of high cost components (170 Controller, 210 Conflict Monitor, CCTV equipment, etc.) or any other component as needed in IMMS. Property Management does not need to be notified when salvaging these components.
- (J) The Central Repair Shops will make every effort to correctly charge repairs in IMMS.
- (K) The Central repair Shops will report any unauthorized district repairs on components. If components are delivered to the shop with obvious signs of unauthorized repairs, note the location and district, and notify Headquarters Maintenance.
- (L) The Central Shops will make every effort to use the most cost-effective methods when performing repairs on components.

**DISTRICT ELECTRICAL MAINTENANCE CREWS**

- (A) The work performed at the asset location by the field crews will be limited to a diagnosis to determine if the modular component is causing the problem. If the modular component is determined to be defective, it will be replaced in its entirety with a new or repaired component. 170 and 2070 controllers will also be reprogrammed with the operating program module. The controller diagnostic module will not be used for field level diagnosis. If the modular component is one listed in (C) below, then it will be disposed of in the district's recycle bin.
- (B) The work performed in each district's Signal Maintenance Shop will be limited to a determination if the modular unit is beyond the point of economical repair, and should be discarded or sent to the Central Repair Shop for repairs. In the case of the 170 controllers, diagnosis of the controller unit can be performed using a diagnostic module. No work will be performed on printed circuit boards or power supplies at this level. The complete controller unit as it came from the field will be sent to the Central Repair Shop with detailed description of the problem and the Special Designation (E-Number) of the location from where it was removed.
- (C) District Electrical Maintenance crews will no longer send the following defective components to their local Central Repair Shop nor will the districts perform any types of repairs on these components. These components are to be disposed of in the district's recycle bins as the cost of handling, shipping and repairing of these items is no longer cost effective.
- Model 200 Switch Packs
  - Model 204 Flashers
  - Model 208 Monitor Unit
  - Model 222 Detector
  - Model 224 Detector
  - Model 242 DC Isolators
  - Model 252 AC Isolators
  - Model 252R AC Isolator

- (D) The District Electrical Maintenance crews will order modular components as needed directly from the Division of Procurement and Contracts (DPAC) Warehouse. These items do not have to be ordered by the Central Repair Shops and the districts do not need approval from the shops to order. The districts can order these directly, and the costs do not effect the district budget. Headquarters Maintenance allocates funds to the warehouse to fund the purchase of these items. Therefore, the funds do not come out of the district's allocation.
- (E) District Electrical Maintenance crews will not send warranty issue components to their Central Repair Shop. These issues are best handled within the districts, unless the component came from the Central Repair Shop. In some cases, the Central Shops may be gathering information about specific components and will notify the districts if there is a need to return these components to the Central Shop.
- (F) District Electrical Maintenance crews will not ship components that are obviously obsolete or beyond the point of economical repair to the Central Shops. Components that are totally destroyed due to third party damage, lightning strikes, etc., can be salvaged (destroyed and disposed of in a recycle bin) within the district, and replaced with a new component from the district's stock. The districts do not need Central Repair Shop approval to replace components. Property Management does not need to be notified when salvaging these components
- (G) District Electrical Maintenance crews will not perform any repairs to controllers, conflict monitors, isolation cards, detector cards, or any other modular component. The roles and responsibilities of the Central Repair Shops and the districts are clearly stated.
- (H) District Electrical Maintenance will store an appropriate number of spare components to ensure safe and proper operations of the field assets independent of the components in route to Central Shops for repairs. This is due to the possibility that components will be salvaged due to repair costs.

**K.04.6 Pedestrian Signal Indications**

When existing WALK-DONT WALK or WALK-WAIT pedestrian signals reach the end of their service life and indications appear dim or need to be relamped, they shall be replaced with the symbol signal. It is acceptable to mix types of pedestrian signals at an intersection.

LED symbol type pedestrian signals shall be used for maintenance replacement of all types of pedestrian signals.

**K.04.7 Arrow Indications**

Use 3-arrow conventional signal face in lieu of PV units with concurrence from Division of Traffic Operations or the district traffic signals operation unit. Remove any conflicting signing. Where the secondary indication for left turns is located at the far left, replacement indications should be 3-arrow conventional heads, in lieu of PV units or 8 inches red louvered, 8 inches yellow louvered, and 12 inches green units.

**K.04.8 Relamping**

**Incandescent Lamps**

Incandescent lamps shall not be used in relamping traffic signals. If a traffic signal has recently been relamped with incandescent lamps, the traffic signal should be group relamped with LED modules one (1) year from that relamp date. If the red indicators have been replaced with LED's, the yellow and green sections should be relamped with LED modules within two (2) years from the last relamp.

**LED modules**

Red LED traffic signal modules should be group relamped every five (5) years. All other modules shall be group relamped every ten years.

**K.04.9 Traffic Signal Conflict Monitors**

Conflict monitors and program cards shall be shop or field tested for proper operation approximately once every 12 months.

Monitor testers shall be shop certified by qualified personnel at Central Repair Facilities approximately every 12 months, or as recommended by the manufacturer.

**K.04.10      Battery Backup Systems (BBS)**

The intent of the battery backup systems installed at traffic signalized intersections shall be to provide emergency power for traffic signals for short power interruptions and the initial response period of long power interruptions. For the operation of traffic signalized intersections beyond the capacity of the BBS, refer to Section K.04.11 (Traffic Signal Operation During an Emergency or a Power Outage). The BBS is not intended to maintain signal operation in the case of an indefinite power interruption.

The batteries for a BBS unit should be replaced at a minimum of every five (5) years or sooner, depending of manufacturer's recommendations. The batteries used to replace shall be 12 VDC, 65 Amp-hr, and be valve regulated, sealed lead-acid type, and be either gel-cel or absorbed glass mat construction. Used batteries shall be disposed of by recycling with an approved battery recycler.

Refer to the Code of Safe Operating Practices for proper handling and disposal procedures for leaking/damaged batteries.

**K.04.11      Traffic Signal Operation During an Emergency or Power Outage**

The emergency mode of operation for all traffic signals shall be flashing operation.

The California Highway Patrol (CHP) or local police are authorized to place a traffic signal on flash or turn it off to direct traffic in the event of any emergency, to expedite traffic, or to ensure safety as conditions may require, notwithstanding any provisions of the Vehicle Code.

The following procedures will be followed in the event of a utility company power outage:

- (A) An unplanned utility company power outage is usually caused by severe weather conditions or system failures such as shorted transformers or downed poles or lines.

This type of outage is unpredictable and usually for an unknown period of time. It will be the general policy of Caltrans not to provide standby electrical power or stop signs at traffic signals during an unplanned utility company power outage as described above. If a permanent battery backup system has been previously installed, the intent is to operate the signals up to the capacity of the batteries, and not to provide additional backup support.

- (B) A utility company may make a planned power shutdown to make repairs on their facilities and request standby electrical power or stop signs from Caltrans when it affects our traffic signals.

It will be the Caltrans general policy, that upon 72 hours notice, to provide standby power or stop signs where possible, consistent with availability of equipment and personnel.

This is the Caltrans general policy on providing backup control at traffic signals during power outages. In power outages, as in any other emergency, it is the function of the California Highway Patrol and the local police to provide immediate short-term traffic control. Generally, the CHP will provide traffic control in unincorporated areas and the local police will provide those services in incorporated areas.

As with any general policy, there may be extenuating circumstances that require exceptions to this policy. These exceptions may be approved by the Deputy District Director, Maintenance.

It is our intent to cooperate as fully as possible with the California Highway Patrol and the local police, consistent with our resources limitations. Contact should be made with the appropriate law enforcement offices to discuss our capabilities and establish the appropriate Caltrans contact person for CHP and the local police then requesting our assistance.

#### **K.05 Flashing Beacons**

Flashing beacons are usually standalone flashing traffic signal indications used to assist in the warning of motorists of a potential danger or to assist in the operation of an intersection controlled by stop signs. Flashing beacons may be red or amber. Flashing traffic signal indications used to warn of an upcoming traffic signalized intersection are part of the traffic signal, and are not standalone flashing beacons.

**K.05.1 Maintenance of Flashing Beacons**

Flashing beacons should be inspected for proper operation at intervals of approximately 120 days. This check should include the following items as a minimum:

**(A) Field Inspection**

- (1) Visual check of indications.
- (2) Signal indication alignment.
- (3) Hardware (hand-hole covers, signs, poles, backplates, etc.).
- (4) Pullbox covers (broken, missing, and clear of dirt or debris).
- (5) Visual check of service cabinet and equipment locks, and flasher circuitry.
- (6) Traffic handling of intersection.

**K.05.2 Group Relamping**

Flashing beacons should be group relamped with the appropriate color, size, and type of LED module every five (5) years.

Incandescent lamps shall not be used in relamping flashing beacons. If a flashing beacon has recently been relamped with incandescent lamps, the flashing beacon should be group relamped with LED modules one (1) year from that relamp date.

**K.05.3 Flashing Beacon Operation During an Emergency or Power Outage**

The emergency mode of operation for all flashing beacons shall be “off” or deactivated. BBS are not to be used with flashing beacons. Maintenance forces shall not respond to a flashing beacon in the event of a power outage. Maintenance forces shall not provide generators or other power sources in the event of a planned power outage by the servicing utility or others.

## **K.06 Freeway Meter Signals**

Freeway meter signals are power-operated traffic control devices, which meter traffic on a freeway. Freeway meter signals may be located on on-ramps, freeway-to-freeway connectors, and on the mainline at the beginning of freeways or major structures. There is no control over conflicting phases at freeway meter signals. Their purpose is the orderly control of traffic on freeways.

### **K.06.1 Maintenance of Freeway Meter Signals**

Meter signals should be checked for damage, proper operation, and timing every 120 days. This check should include the following items as a minimum:

#### **(A) Field Inspection**

- (1) Visual check of indications.
- (2) Signal indication alignment.
- (3) Hardware (hand-hole covers, signs, poles, backplates, etc.).
- (4) Pullbox covers (broken, missing, and clear of dirt or debris).
- (5) Visual check of service cabinet and equipment locks.
- (6) Visual check of loops in roadway (if possible).

**(B) Cabinet Interior**

- (1) Controller unit indicator lights and display.
- (2) Function and timing.
- (3) Detector indicator lights and operation.
- (4) Check output devices, including interconnect systems.
- (5) Thermostat and ventilation system including filter.
- (6) Clean cabinet and interior components.
- (7) Check documentation (timing sheets, schematics, wiring plans, etc., and inspection noted on cabinet login card).

**(C) Cabinet Exterior**

- (1) Condition of surface (paint, damage, graffiti).
- (2) Condition of locks and handles.
- (3) Operation of Police panel switches.

**K.06.2 Meter Timing and Operations**

Initial timing of meter signals and any subsequent changes in timing shall be the responsibility of the Division of Traffic Operations or the district traffic operation unit.

Maintaining the timing is the responsibility of the Division of Maintenance or the district Electrical Maintenance unit.

Temporary timing changes can be made by the Division of Maintenance or the district Electrical Maintenance unit to compensate for sudden changes in traffic conditions or malfunctioning traffic signal equipment that cannot be repaired or replaced immediately.

In the event of a malfunction that cannot be compensated for in the software, the meter signal shall be deactivated until proper repairs can be made.

The Division of Traffic Operations or the district traffic signals operation unit must be notified of any temporary timing changes or deactivations as soon as possible.

Signal Timing Forms will be prepared and furnished by the Division of Traffic Operations or the district traffic signals operation unit and a copy sent to the Division of Maintenance or the district Electrical Maintenance unit.

Meter timing records should be kept by both the Division of Traffic Operations or the district traffic signals operation unit, and the Division of Maintenance or the district Electrical Maintenance unit.

Any observed timing or operational traffic metering problems should be promptly reported to the Division of Traffic Operations or the District Traffic Operations unit.

There is no standard statewide meter signal controller software for the Model 170 controller. Personnel working on meter signals should familiarize themselves with the software version used on the meter signals in their areas.

#### **K.06.3          Group Relamping**

##### **(A) Incandescent Lamps**

Incandescent lamps shall not be used in relamping meter signals. If a meter signal has recently been relamped with incandescent lamps, the meter signal should be group relamped with LED modules two (2) years from that relamp date. If the red indications have been replaced with LEDs, the yellow and green sections should be relamped with LED modules within three (3) years from the last relamp. If a meter signal is used in limited operation, it should be relamped with LED modules three (3) years from the last relamp date.

##### **(B) LED modules**

LED traffic signal modules should be group relamped every 15 years.

**K.06.4          Meter Signal Operation During an Emergency or Power Outage**

The emergency mode of operation for all meter signals shall be “off” or deactivated. BBS systems are not to be used with meter signals. Maintenance forces shall not respond to a meter in the event of a power outage. Maintenance forces shall not provide generators or other power sources in the event of a planned power outage by the servicing utility or others.

**K.07          Traffic Management Systems (TMS) Field Elements**

TMS field elements are systems that are controlled and/or monitored by the District Traffic Management Center (TMC), and do not directly control traffic. Examples of these systems are changeable message signs (CMS), closed circuit television cameras (CCTV), and vehicle detector stations (VDS). Due to the changing nature of the technology employed by the TMCs, these systems are varied in appearance and operation. Close attention should be paid to any manufacturer’s maintenance and operations manual.

**K.07.1          Changeable Message Signs (CMS)**

All types of changeable message signs should be routinely inspected for proper operation at least every 120 days. This check should include the following items as a minimum:

- (A) Field Inspection
  - (1) Visual check of indications.
  - (2) Sign Panel
    - (a) Check inter-connectable connections.
    - (b) Test pixel matrix for failures.
    - (c) Replace pixels or pixel matrix modules.
  - (3) Pullboxes (damage, covers missing or damaged).
  - (4) Visual check of service cabinets and locks.

**(B) Cabinet Interior**

- (1) Controller and associated units indicator lights.
- (2) Function, timing, and communications (modem).
- (3) Thermostat and ventilation system including filter.
- (4) Clean cabinet and interior components.
- (5) Check documentation (schematics, wiring plans, etc.).
- (6) Check operation of all GFI receptacles.
- (7) Check that cables are not stressed.
- (8) Check components mounting hardware securely fastened.
- (9) Remove any dirt and debris.
- (10) Clean dimming sensor.

**(C) Cabinet Exterior**

- (1) Condition of surface (paint, damage, graffiti).
- (2) Condition of locks and handles.

Changeable message signs should be relamped as required. When relamping a CMS with xenon pixel matrix modules (PMM), consideration should be given to relamp the CMS with LED PMMs. Contact the Division of Maintenance for further guidance and information on the use of LED PMMs.

**K.07.2 Closed Circuit Television Systems (CCTV)**

All closed circuit television systems should be routinely inspected for proper operation every 180 days for proper operation, or as per manufacturers recommendation. Due to possible presence of fiber optic equipment and cabling, or other special equipment, only qualified personnel are to perform routine maintenance inside camera control cabinets. Read Section K.07.9 for further instruction on the maintenance of TOSNet field communications systems. This check should include the following items as a minimum:

(A) CCTV Camera Assembly:

- (1) Visual check of camera assembly and cables.
- (2) Inspection of camera control sub-assemblies for proper operation and function as per manufacturer's instructions.
- (3) Clean enclosure window.
- (4) Check humidity indicators
- (5) Camera Control Check enclosure pressure.
- (6) Re-charge enclosure pressure (every year).
- (7) Insure pan/tilt drive unit operates freely over entire range of pan/tilt travel.

(B) CCTV Receiver:

- (1) Condition of surface (paint, damage, graffiti).
- (2) Condition of locks and handles.
- (3) Check mounting screws are securely fastened.
- (4) Check cable connections are securely fastened.
- (5) Using a lap-top computer check the following:
  - (a) Pan/tilt operation from stop to stop.
  - (b) Lens zoom in/out.
  - (c) Iris auto/manual (adjust iris as necessary).

(C) Video Transmitter:

- (1) Using a power meter, measure and record optical output power.
- (2) Check power light.
- (3) Check cable connections.

(D) Fiber Distribution Unit:

- (1) Clean end of fiber.
- (2) Check spare fiber is capped.
- (3) Check fiber is not stressed.

(E) Field Equipment Cabinet:

- (1) Check operation of all GFI receptacles.
- (2) Check cables are not stressed.
- (3) Check operation of fan.
- (4) Check component mounting hardware is securely fastened.
- (5) Remove any dirt and debris.
- (6) Change vent filter.

**K.07.3 Wrong Way Detection systems**

All wrong way detection systems should be routinely inspected every 90 days for proper operation.

**K.07.4      Vehicle Detection Systems**

All Vehicle Detection Systems should be routinely inspected for proper operation every 120 days. This check should include the following items as a minimum:

**(A)   Field Inspection**

- (1)   Hardware (hand-hole covers, signs, poles, backplates, etc.).
- (2)   Pullbox covers (broken, missing, and clear of dirt or debris).
- (3)   Visual check of service cabinet and equipment locks.
- (4)   Visual check of loops in roadway (if possible).
- (5)   Visual check of detector sensor (other than loops).

**(B)   Cabinet Interior**

- (1)   Controller unit indicator lights and display.
- (2)   Function and timing.
- (3)   Detector indicator lights and operation.
- (4)   Check output devices, including interconnect systems.
- (5)   Thermostat and ventilation system including filter.
- (6)   Clean cabinet and interior components.
- (7)   Check documentation (timing sheets, schematics, wiring plans, etc.).

**(C)   Cabinet Exterior**

- (1)   Condition of surface (paint, damage, graffiti).
- (2)   Condition of locks and handles.

Examples of different Vehicle Detection Systems include the following:

- (A) Inductive loop detector.
- (B) Magnetometer.
- (C) Magnetic detector.
- (D) Micro-loop inductive detector.
- (E) Microwave Vehicle Detection System (MVDS): (RTMS is one example).
- (F) Video Image Processing System (VIPS) (for specific items to check during PM check, see the section on CCTV systems, K.07.02.).

#### **K.07.5          Fiber Optic Systems (TOSNet)**

All fiber optic systems should be routinely inspected for proper operation every 120 days or as per manufacturer's recommendation. Due to specialized equipment and fiber optic cabling, only qualified personnel are to perform routine maintenance inside fiber optic cabinets. Read Section K.07.9 for further instruction on the maintenance of TOSNet field communications systems.

This check should include the following items as a minimum:

- (A) Cabinet Exterior
  - (1) Condition of surface (paint, damage, graffiti).
  - (2) Condition of locks and handles.

**K.07.6 Highway Advisory Radio (HAR)**

All HAR systems should be routinely inspected for proper operation every 120 days. Due to specialized equipment, only qualified personnel are to perform routine maintenance inside HAR cabinets. Assistance with HAR installations may be obtained from Division of Maintenance, Office of Radio Communications. This check should include the following items as a minimum:

**(A) Equipment**

- (1) Check range of transmitter signal.
- (2) Check power supply level.
- (3) Field equipment cabinet.
- (4) Check operation of all GFI receptacles.
- (5) Check that cables are not stressed.
- (6) Check operation of fan.
- (7) Check component mounting hardware is securely fastened.
- (8) Remove any dirt and debris.
- (9) Change vent filter.

**(B) Flashing Beacon**

- (1) Check pole mounting hardware.
- (2) Check flasher circuitry.

**(C) Field Inspection**

- (1) Check condition of storage batteries, if solar panel is present.
- (2) Contact traffic management center to turn on flashers and check for proper operation.
- (3) Inspect and clean flasher lens and solar panel if present.
- (4) Inspect advisory sign for damage or graffiti.

**K.07.7 Communication Hubs (TOSNet)**

All field communications systems should be routinely inspected for proper operation every 120 days. Due to specialized equipment and fiber optic cabling, only qualified personnel are to perform routine maintenance as per manufacturer's recommendations. Read Section K.07.9 for further instruction on the maintenance of TOSNet field communications systems. This check should include the following items as a minimum:

**(A) Building Exterior**

- (1) Check door locks and handles for damage.
- (2) Check condition of surface for graffiti, damage, etc.

**(B) Optical Receiver Rack**

- (1) Check power and carrier lights are operative.
- (2) Check coax and optical fiber connections are clean and secure.
- (3) Using power meter, measure and record optical receive levels.
- (4) Check that fibers are not stressed.
- (5) Check all unused fiber terminations are capped.

**(C) Video Multiplexer and Demultiplexer**

- (1) Remove and clean each circuit card with a vacuum cleaner and small brush.
- (2) Check coax cable connections are secure.
- (3) Check optical fiber connections are clean and secure.
- (4) Check power supplies' LED indicators are lit.
- (5) Using power meter, check and record optical output power.
- (6) Check status of all LED indicators on all cards.

**(D) Channel Bank**

- (1) Check mounting screws are securely fastened.
- (2) Check cable connections are securely fastened.
- (3) Check power supplies' LED indicators are lit.
- (4) Check line interface unit (LIU) LED indicators are all lit.

**(E) DS-1 Optical Modem**

- (1) Using power meter, measure and record optical output power.
- (2) Using power meter, measure and record optical receive power.
- (3) Check power light is operative.
- (4) Check data cable connection screws are not loose.
- (5) Check optical fiber connection is clean and secure.

(F) Video Monitor

- (1) Check all controls operate properly.
- (2) Check coax cable connections are secure and not stressed.
- (3) Check appropriate termination at rear of unit.
- (4) Clean monitor assembly.

(G) General

- (1) Check operation of all GFI receptacles.
- (2) Check cables are not stressed.
- (3) Check operation of all fan assemblies.
- (4) Check component mounting hardware securely fastened.
- (5) Remove any dirt and debris.
- (6) Check A/C unit is operating properly.

**K.07.8 TMS Field Element Operation During an Emergency or Power Outage**

The emergency mode of operation for all TMS field elements shall be “off” or deactivated. Battery backup systems are not to be used with TMS field elements. Maintenance forces shall not respond to a TMS field element in the event of a power outage. Maintenance forces shall not provide generators or other power sources in the event of a planned power outage by the servicing utility or others.

It is understood that some TMS field elements may be solar/battery powered for normal operations.

**K.07.9          Maintenance of TOSNet Communications Systems to TMS Field Elements**

The normal maintenance functions on the TOSNet field communications systems are to be coordinated and monitored by the District Traffic Operations unit, and performed by the TOSNet contractors. The district Electrical Maintenance crews are to assist the TOSNet contractor(s) when workload and resources permit. This includes the communications equipment for all TMS field elements and ramp meters, as well as communications hubs, and fiber-optic systems.

**K.08          Traffic Census Counters/Speed Monitor Stations**

Traffic census counters and speed-monitoring stations are systems that used periodically to monitor conditions on the State highway system.

All traffic count loop detectors should be checked and repaired on notification of malfunction by Traffic Operations Program or District Traffic Operations unit. Since the use of these systems is not continuous, there is no predefined preventative maintenance interval.

**K.09          Miscellaneous**

**K.09.1          Painted/Decorative Standards and Poles, and Painted Hardware**

New or existing steel standards and poles for traffic signals should not be painted or repainted by State forces.

Participating local agencies may be granted permission to paint steel standards and poles or use decorative standards or poles on State highways to match painted or decorative standards and poles on their streets or roads. The local agency will be responsible for maintaining the visual aesthetics of the painted/decorative standards or poles. The local agency shall be responsible for providing replacement standards or poles in the event replacement is necessary. The use of decorative poles shall be approved by the Division of Engineering Services for compliance with Caltrans structural standards. The division of responsibility for painted steel or decorative standards and poles should be delineated in the Electrical Maintenance Agreement (see section K.09.2).

When existing galvanized signal standards and poles are not repainted to maintain color, deteriorated paint should be removed or painted over with aluminum paint.

On non-galvanized (painted) steel signal standards and poles (that are not being maintained by the local agency) or on galvanized steel signal standards and poles where the galvanizing is in poor condition, surfaces should be maintained as required. Replacement of deficient standards, mast arms, and poles should be considered.

Interior of signal visors, louvers and front faces of back-plates should be painted with flat black paint. Signal heads, signal head mountings, brackets and fittings, outside of visors, pedestrian push button housings, pedestrian signal head housings and visors, and back of back-plates, should be painted with flat black or dark olive green paint.

#### **K.09.2          Distribution of Traffic Signal and Lighting Costs**

The cost of maintenance and energy of traffic signals and highway lighting facilities at intersections of county roads and/or city streets with a conventional State highway should be shared between the agencies concerned in the same ratio as the number of legs in the intersection under each jurisdiction bears to the total number of legs.

In accordance with the above, the cost of maintenance and energy of a traffic signal and intersection lighting on a 4 leg crossing at grade would be shared on a 50-50 basis. Such costs on a "T" or "Y" intersection at grade would be shared on a  $33 \frac{1}{3}$  -  $66 \frac{2}{3}$  basis.

The same principle of cost distribution will apply to freeways, except that with interchanges the concept of the overall facility will be used. The participation ratio will be based on the ratio of the number of legs of the respective agencies to the total number of legs of the interchange facility.

In Example "A" (Page K-31) we have a simple diamond interchange, which is a State facility crossing a local facility, with lighting and a traffic signal at the intersection of the local facility and the State ramps. This type of interchange is similar to a 2-quadrant cloverleaf. The cost distribution would be  $\frac{1}{2}$  local,  $\frac{1}{2}$  State.

At a "T" type interchange it would be  $\frac{1}{3}$  local,  $\frac{2}{3}$  State.

Frontage roads that may be adjacent to the freeway, and intersect only with the local road, should not be considered a part of the interchange facility. These intersections are local and 100 percent the responsibility of the local agency.

Some frontage roads are integrated with the interchange such as the case where the freeway ramps connect to the frontage road before connecting to the local road as shown on Example "B". Usually, in this case, the short piece of frontage road between the ramp terminal and intersecting local road should be considered as belonging to the local agency, even though it is used to complete the interchange with the local road. The frontage roads approaching the interchange cannot be considered local legs of the interchange and should not be counted as local legs. In general, the freeway will be intersecting with the local road or street and not the frontage roads constructed strictly for property access. An isolated ramp; Example "E", cannot be considered an interchange, and we must then use the concept of an intersection at grade. The participation ratio of Example "E" would then be 1/3 State and 2/3 local.

Example "H" shows a State highway intersecting a City/County street or road and a driveway. The cost distribution would be shared on a 50-50 basis between the State and city/county. City/county is responsible for the driveway leg. Costs, to be shared, are accrued in those areas in the immediate vicinity of the intersections considered to be within the interchange. These are intersections of the various ramps and/or frontage roads with city streets and county roads. While the typical examples at the end of this chapter are to be used as a guide, there may be extenuating circumstances that may allow further consideration based on local conditions.

A past alternate method of sharing maintenance and energy costs was to have the local agency bear 100 percent of the energy costs, and the State bear 100 percent of the maintenance costs.

New facilities may be added to the Exhibit "A" of an existing agreement. Existing agreements of this type may stay in effect until the facilities covered by this agreement are no longer in service, the facilities are relinquished, or the agreement is terminated and replaced by a new Electrical Maintenance Agreement. If a new agreement is to be initiated, all facility costs are to be shared according to the standard Electrical Maintenance Agreement.

#### **K.09.3      Safety Precautions**

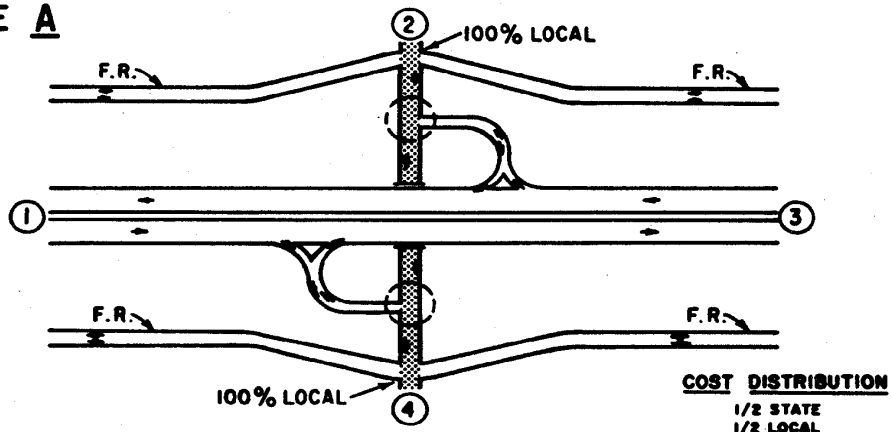
It is the responsibility of all Maintenance Managers, Caltrans Highway Electrical Maintenance Supervisors, and employees to understand and follow the applicable Codes of Safe Practices. All pertinent Departmental Maintenance Manual sections, Departmental Safety Manual sections, Departmental Policy and Procedure Memoranda, Safety Orders, Maintenance Code of Safe Practices Manual, and district instructions relating to employee safety and health are to be followed.

July 2006

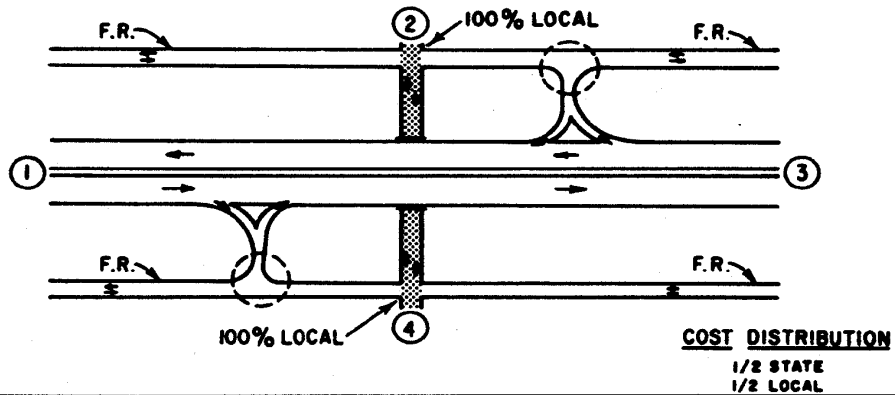
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**DISTRIBUTION OF SIGNAL AND LIGHTING  
COSTS ON FREEWAYS**

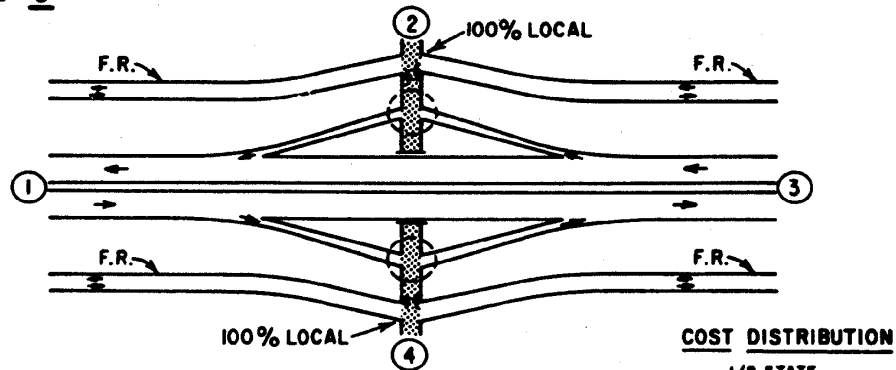
**EXAMPLE A**



**EXAMPLE B**

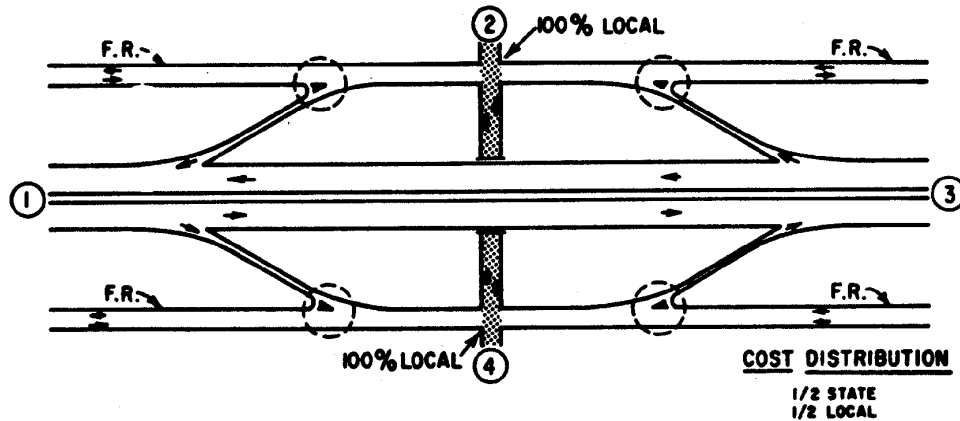


**EXAMPLE C**

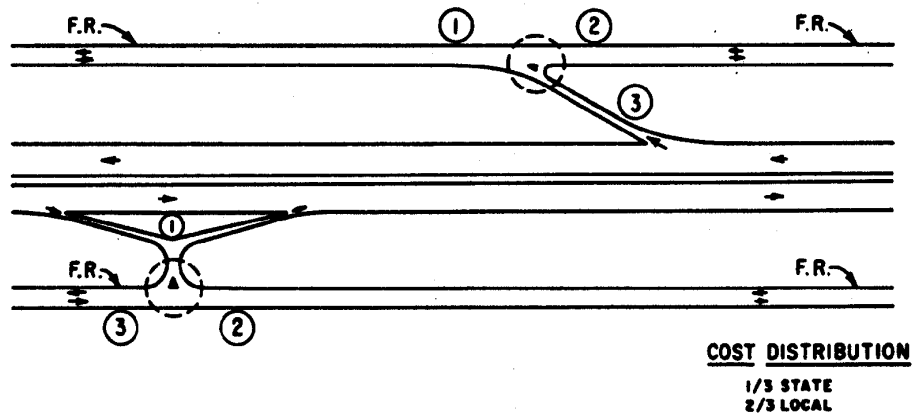


**DISTRIBUTION OF SIGNAL AND LIGHTING  
COSTS ON FREEWAYS**

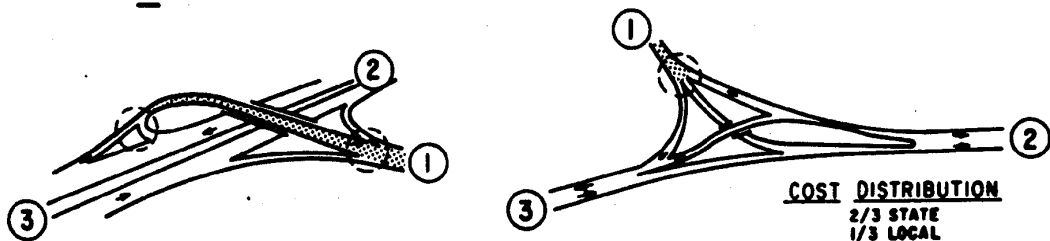
**EXAMPLE D**



**EXAMPLE E**

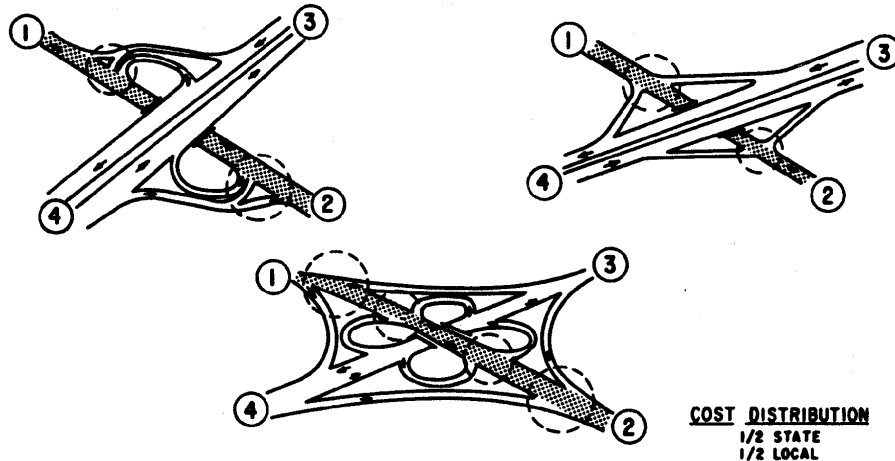


**EXAMPLE F**

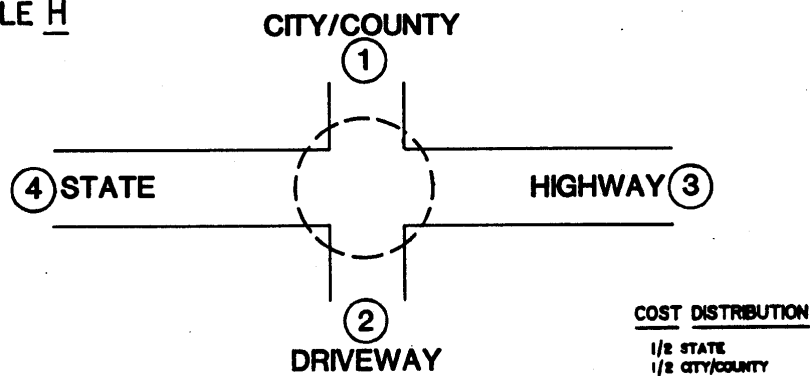


**DISTRIBUTION OF SIGNAL AND LIGHTING  
COSTS ON FREEWAYS**

**EXAMPLE G**



**EXAMPLE H**



**NOTE:** RATIO OF PARTICIPATION IS BASED ON NUMBER OF LEGS AS NUMBERED.

——— -STATE HIGHWAY

——— -COUNTY ROAD OR CITY STREET

F.R. -FRONTAGE ROAD

○ -APPROX. AREA OF INTERSECTION WHEREIN LIGHTING AND  
SIGNAL MAINTENANCE COSTS, TO BE SHARED, ARE ACCURED

# **CHAPTER M**

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### **Section 1   Pavement Delineation (Family Problems M1, M2, & M3)**

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Division of Maintenance

**M1.00 Introduction ( Family Problems M1, M2, M3 )**

This Chapter covers all work to replace and maintain roadway delineation and pavement markings/markers.

It includes work in the following Family/Problem areas:

- M1 Pavement Striping
- M2 Pavement Markings
- M3 Raised Pavement Markers
- M9 Inventory Updating (portion)

Typical work on pavement delineation and markings may include the following:

- (A) Inspection of pavement delineation
- (B) Layout for replacement purposes
- (C) Refurbishing delineation
- (D) Replacement of missing markers
- (E) Repainting of red curbs where it is a State obligation

Work in the “M” Family includes only pavement marking and delineation on the traveled way, shoulders, ramps, and auxiliary lanes. It does not include markings, legends, parking stalls, or at roadside rest areas, weigh stations, and other public service locations. Work in such areas should be reported to the “G” Family, Public Facilities.

The Traffic Manual has been replaced by the Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) as amended by the most current version of the California Supplement to the MUTCD (Supplement), herein referred to as the MUTCD and the CA Supplement. Contact the Division of Traffic Operations or the Division of Maintenance for additional information or advice on the MUTCD and the CA Supplement. Attention is directed to the Division of Traffic Operations homepage for the Office of Signs, Markings and Permits.

Signs referenced with (CA) in this chapter indicate a California sign code. Otherwise, the sign code referenced is a Federal sign code.

**M1.01 Levels of Maintenance**

**(A) Inspection**

A formal night inspection of all pavement delineation condition shall be completed once each year. Results of the pavement delineation condition survey shall be recorded and utilized to develop the work plan. Date of inspection and restoration shall be included in the records.

**(B) Pavement Stripes and Markings**

Pavement stripes and markings should be renewed when, in the judgment of the supervisor or District Traffic Operations, they have lost their effectiveness. The assigned supervisor shall have the primary responsibility for identifying deficiencies. All employees, however, should be instructed to report observed deficiencies.

**(C) Missing or Ineffective Pavement Markers**

Missing or ineffective pavement markers that significantly affect configuration of the line should be considered for replacement. Whenever possible, replacement should be scheduled in conjunction with other Maintenance operations to minimize disruptions to traffic.

**M1.02 Responsibility**

When needed, the existing pavement delineation pattern shall be replaced with the identical delineation pattern. There shall be no deviation from the standards illustrated or written in the MUTCD and the CA Supplement, and no traffic stripe or raised markers shall be placed except at locations indicated in that manual without direction from District Traffic Operations. Installation Orders provided by District Traffic Operations for placement of new or modified delineation shall show the location and type on a print, authorized by Deputy District Director, Traffic Operations. Questions regarding Installation Orders should be directed to District Traffic Operations. It is acceptable to substitute materials different from the original material being replaced, such as thermoplastic instead of water-borne paint, or thermo-plastic in place of non-reflective raised pavement markers.

Maintenance of signs and pavement markings placed off the right of way for roads entering the State highway, may be an obligation of the Department when they are placed primarily for the protection of traffic on the State facility. Examples are pavement markings that support the R1-1 STOP and W3-1 STOP AHEAD signs. It is standard practice for the owner of the entering facility to fund the initial installation. Future maintenance costs, including clearing of trees and brush to improve visibility of signs, should be borne by the Department.

Districts are responsible for the placement and maintenance of limit lines (stop bars) at both existing and new paved approaches to a State highway. Only those “STOP” pavement markings requested by District Traffic Operations should be maintained. Districts will coordinate the work of the pavement marking and sign crews for these installations. The preceding instruction is not intended to preclude establishment of Maintenance Agreements whereby local agencies assume these responsibilities.

Where local governmental agencies have been delegated pavement delineation responsibilities by Maintenance Agreement, their performance shall conform to the standards set forth in this chapter. The district must periodically inspect delineation to assure that local agencies are maintaining acceptable standards.

### **M1.03 Safety**

It is the responsibility of all Caltrans highway Maintenance personnel to understand and follow the rules written in the Code of Safe Practices and any other safety laws, rules, Policy and Procedures, and safety guidelines, pertaining to the work being performed.

Employees shall be provided with, and shall wear, required personal protective equipment applicable to the work being done. Before work starts, Material Safety Data Sheets (MSDS) for any substances used shall be reviewed, and all crew members made aware of any potential toxic hazards in the work. Pavement delineation equipment, including appropriate support equipment, shall be maintained and operated in a manner that promotes good safe practices, does not pose a hazard to other employees or the general public, or to the environment.

Thermoplastic material heated to excessive temperatures can flash and splatter when the material is drawn and exposed to air. Temperature gauges mounted on thermoplastic application equipment shall be checked at frequent intervals. Equipment found to have defective temperature gauges shall not be used until repaired.

While removing or applying pavement delineation, all traffic control and worker protection shall conform to Chapter 8 of this manual, Protection of Workers.

### **M1.04 Layout**

The term “layout” refers to the process of placing reference marks on the pavement to be used as a guide for locating pavement delineation on the roadway surface.

Reference marks may also occasionally be located on curbs or sidewalks. In snow areas, saw cuts in the pavement can be used to identify the location of left turn lane pockets. Pictures of pavement delineation can also provide a valuable reference for replacement in kind.

Reference marks are a guide for placement of pavement delineation and are not to be used as temporary lane line.

**M1.05 Pavement Delineation on Resurfaced Areas**

**(A) Requirement for Replacement of Pavement Delineation**

All lane line pavement delineation that has been covered must be replaced (permanent or temporary) at the end of the operation each day. The person in charge of the field operation will be responsible to take proper action to assure that the correct type of pavement delineation is placed within the required time frames.

- (1) Permanent pavement delineation covered by Maintenance or Construction activities should be replaced within one (1) week and shall be replaced within two (2) weeks. In the interim, “short-term” delineation measures shall be used.. Contact District Traffic Operations or the Headquarters Maintenance Division for the latest instructions.
- (2) Temporary lane lines shall be placed before leaving the job site, if permanent delineation cannot be restored by the end of the work shift. Various types of day/night raised retroreflective markers are approved for short-term use. These markers are to be placed on not more than 24-ft. centers on curves and tangent.

On liquid asphalt concrete patches, a temporary day/night marker, secured by butyl adhesive to a 1-ft. piece of temporary foil-backed tape, has proven capable of staying in place while the patch cures.

**(B) Specific Instructions for Placement of Signs**

- (1) On two lane conventional highways where no passing-zone lane line has been covered, a sign package consisting of a W20-1 ROAD WORK AHEAD and an R4-1 DO NOT PASS sign shall be posted within 1000 ft. of the no passing zone. The R4-1 DO NOT PASS sign should be posted at 2,000 ft. intervals throughout the extended no-passing zone. The R4-2 PASS WITH CARE sign should also be placed at the end of the zone.
- (2) On seal coats more than two (2) miles in length, the above instruction could be modified by posting a W20-1 ROAD WORK AHEAD sign at each end of the job, supplemented with a W7-3a NEXT XX MILES black on orange plate below the sign.

If a no-passing zone is continuous throughout the seal coated area, an R4-1 DO NOT PASS sign shall be placed at the beginning of the zone and at maximum 2,000 ft. intervals.

- (3) Obliterated edge lines are not to be replaced with temporary dashes or retroreflective markers. When edge line delineation is required because of narrowing pavement or curvilinear alignment, portable delineators (guide markers) may be used to guide traffic.

**(C) Delays in Placement of Permanent Pavement Delineation**

It is understood that equipment breakdown, weather, or other problems may unavoidably delay placement of permanent pavement delineation. It is important that the reason for delay be documented and filed with the project files.

**(D) Exceptions to the Two Week Time Limit**

Exceptions to the 2-week time limit to restore permanent delineation are as follows:

- (1) Cure time of pavement before placing raised markers.
- (2) Winter conditions where pavement delineation cannot be maintained due to rain snow, plowing, etc.
- (3) Short patches that are less than 500-ft. long on tangent alignment where the pavement is visible when entering the patch from either direction. This exception is intended for only single patches not placed in close proximity to another.

Under no circumstances shall a job site be left without at least temporary delineation and or signs as noted above.

**M1.06 Pavement Delineation Removal**

The acceptable methods of removing pavement delineation are horizontal rotary grinding and sandblasting.

When using either of these methods to remove legends, the entire pavement surface within the area of the legend shall be removed. Failure to remove the surface of the entire legend area can result in the former message being conveyed by the resulting scar on the pavement surface.

Paint or asphalt emulsion shall not be used to cover pavement delineation except as a temporary measure until permanent repairs can be made. A general guideline for temporary is six (6) months or less. Pavement that has been covered with paint or asphalt emulsion for more than six (6) months should be scheduled for permanent removal when workload allows. The crew supervisor, in consultation with the Superintendent, shall determine if permanent removal is more appropriate than a temporary cover of the pavement delineation when the Installation Order is issued by the District Traffic Operations unit.

Raised markers are sometimes removed on small jobs using hand tools such as pry bars, hammer and screwdriver, or chisel. Large removal projects can best be accomplished by utilizing a special attachment on a motor grader.

#### **M1.07 Environmental Concerns**

Caltrans districts will be responsible for monitoring and acting as independent agents in dealing with local air quality control districts. The California Environmental Protection Agency (Cal/EPA) may override local district rulings.

Residue of paint from color changes or cleaning tanks is to be handled as a hazardous waste.

Paint guns shall not be purged on shoulders. Each Caltrans district should follow established procedures adopted in their area for picking up and disposing of these materials.

Current law provides that individual employees may be held personally liable for penalties assessed for willful or negligent infractions of these rules. Caltrans will take disciplinary action against employees who violate hazardous waste disposal laws, up to and including termination of employment.

#### **M1.08 Recessed Delineation Materials**

Grinding slots in the pavement and placing recessed markers and/or thermoplastic material in those slots has greatly extended the life of pavement delineation in some areas. Materials installed in the recessed areas include retroreflective pavement markers and thermoplastic. Typical areas selected for this type installation include highways with high weave/heavy traffic and snow removal conditions.

#### **M1.09 Longitudinal Pavement Markings**

- (A) Longitudinal pavement markings serve the following specific traffic guidance functions:
  - (1) Single broken white line is used to delineate the edge of a traffic lane where traffic is permitted in the same direction on both sides of the line.
  - (2) Single broken yellow line is used to delineate the left edge of a traffic lane where overtaking with care is permissible for traffic in either direction of travel.

- (3) Single solid white line is used to delineate the edge of a traffic lane where travel in the same direction is permitted on both sides of the line, but crossing the line is discouraged. It is also used to mark the right edge line.

A wide solid white line is used for emphasis where crossing it requires unusual care. It is also used as a line to delineate turnouts, left or right turn lanes, and bicycle lanes.

- (4) Single solid yellow line delineates the left edge line of each roadway of divided streets or highways, one-way roadways, and ramps in the direction of travel.
- (5) Double yellow line consisting of a single broken yellow line and a single solid yellow line delineates a separation between traffic lanes in opposite directions where overtaking with care is permissible for traffic adjacent to the broken line, and is prohibited for traffic adjacent to the solid line.

This pattern is also used to delineate a two-way left turn lane in which the solid line is placed on the outside. Traffic adjacent to the solid line may cross this marking with care only as part of a left-turn or U-turn maneuver.

- (6) Double line consisting of two (2) solid yellow lines delineates the separation between traffic lanes in opposite directions where overtaking is prohibited in both directions. It is used as a channelizing line in both directions. It is frequently used as a channelizing line in advance of an obstruction that must be passed on the right. Black paint should be used between the yellow stripes to improve definition and maintain the interior gap during repainting.
- (7) Dotted line may be used to delineate the extension of a line through an intersection or an interchange area. The dotted line shall be the same color of the line it extends.

More information on this subject is included in Part 3 of the MUTCD and the CA Supplement, and in the Standard Plans.

### **M1.10 Pavement Markings - General**

Pavement markings are used to supplement traffic signs conveying messages or directions to the motorist, particularly at locations where pavement width or dense traffic prevent motorists from seeing the signs readily.

Approval of District Traffic Operations must be obtained before using other than standard markings.

District Maintenance will continue to work with District Traffic Operations to identify pavement markings that are obsolete and should not be maintained. Documentation is required from District Traffic Operations before maintenance of pavement markings is waived. A District Traffic Operations Installation Order (IO) will be required prior to removal by grinding or other methods of any pavement markings.

Stencils used to place pavement markings shall be of uniform dimension. The California standard is shown in the Standard Plans, Plates A-24A through A-24E.

Additional information regarding pavement markings is included in Part 3 of the MUTCD and the CA Supplement.

### **M1.11 Pedestrian Crossings**

Attention is directed to Part 3 of the MUTCD and the CA Supplement. Pedestrian crosswalk markings may be placed at intersections, representing extension of sidewalk lines, or on that portion of the roadway distinctly indicated for pedestrian crossing. Crosswalks and related pavement markings will be painted white or yellow depending on location. Crosswalk markings serve primarily to guide pedestrians in the proper paths.

Pedestrian crosswalk markings should not be used indiscriminately. Unwarranted crosswalks can be detrimental to pedestrian safety by providing a false sense of security.

Replacement by highway Maintenance personnel of crosswalks at intersections of local streets with State highways shall be confined to State highway surfaces. Where possible, this work should be delegated to local authorities under a cooperative Maintenance Agreement.

When markings are to be covered by resurfacing, the District Traffic Operations should be requested to review the project for removal of markings that are no longer necessary or are redundant.

### **M1.12 School Area Pedestrian Crossings**

Attention is directed to Part 7 of the MUTCD and the CA Supplement. Pedestrian crosswalks and related pavement markings will be painted yellow or white, depending on the location of the school building or grounds with respect to the highway. In this regard, Section 21368 of the California Vehicle Code provides as follows:

Whenever a marked pedestrian crosswalk has been established in a roadway next to a school building or the grounds thereof, it shall be painted or marked in yellow, as shall be all the marked pedestrian crosswalks at an intersection.

Other established marked pedestrian crosswalks, may be painted or marked in yellow, if either (a) the nearest point of the crosswalk is not more than 600 ft. from a school building, or the grounds thereof, or (b) the nearest point of the crosswalk is not more than 2,800 ft. from a school building, or grounds thereof, there are no intervening crosswalks, other than those next to the school grounds, and it appears that the circumstances require special painting, or marking of the crosswalk, for the safety of persons attending the school.

There shall be painted or marked in yellow on each side of the street in the lane or lanes leading to all yellow marked crosswalks the following words, "SLOW--SCHOOL XING." Such words shall not be painted or marked in any lane leading to a crosswalk at an intersection controlled by stop signs, traffic signals or yield right of way signs. A crosswalk shall not be painted or marked yellow at any location other than as required or permitted by this section.

All school pavement delineation shall conform to Part 7 of the MUTCD and the CA Supplement. Sign installation should be coordinated with delineation placement.

### **M1.13 Transverse Markings**

Transverse markings which include shoulder markings, word and symbol markings, limit lines (stop bars), crosswalk lines, markings for highways patrolled by aircraft, parking stall markings, and others shall be white, except for yellow markings near schools as provided in Part 7 of the MUTCD and the CA Supplement. Transverse median markings shall be yellow.

### **M1.14 Parking Regulation Curb Markings**

Section 21458 of the Vehicle Code authorizes the use of paint on curbs to show parking regulations. The following colors shall be used as indicated.

Red	No stopping, standing, or parking.
Yellow	Loading.
White	Stopping for loading at specified times.
Green	Short time limit parking.
Blue	Indicates parking limited exclusively to the vehicles of persons with disabilities.

Painting and maintenance of curb markings to show parking regulations are the responsibility of the local agency. An exception occurs when curb markings have been installed at the request of the State to meet traffic operational and/or safety needs. This type of work should be delegated to local agencies by means of Maintenance Agreements.

### **M1.15 Limit Lines (Stop Bars)**

Limit lines (CVC377) are solid white lines, normally 12 inches to 24 inches wide, extending across all approach lanes to indicate the point behind which vehicles are required to stop.

If a marked crosswalk is in place, it would normally function as a limit line. For added emphasis, a limit line may be placed 4-ft. in advance and parallel to the crosswalk line nearest approaching traffic.

In the absence of a marked crosswalk, the limit line should be placed at the desired stopping point. This point is typically no more than 30-ft., nor less than 4-ft. from the nearest edge of the intersecting roadway.

If a limit line is used in conjunction with a stop sign, it should ordinarily be placed in line with the STOP sign. However, if the sign cannot be located exactly where vehicles are expected to stop, the limit line should be placed at the stopping point.

A limit line shall be placed on paved approaches to State highways, and a "STOP" pavement marking may be placed if specifically requested by the District Traffic Operations.

### **M1.16 Parking Stall Markings**

The placement and maintenance of parking stalls is the responsibility of the local agency. An exception to the above practice may be made when a State highway-resurfacing project covers existing parking lines. In this case it is the responsibility of the Department for replacement of the parking markings. Parking stall markings shall be white. Refer to Part 3 of the MUTCD and the CA Supplement for details of parking stall layout.

### **M1.17 Pavement Arrows**

Primary use of pavement arrows is at freeway entrance and exit ramps, turn lanes and lane reduction locations. Type of arrow and proper location can be found in Part 3 of the MUTCD and the CA Supplement.

### **M1.18 Railroad and Light Rail Crossings**

Attention is directed to Part 3, Part 8, and Part 10 of the MUTCD and the CA Supplement. Pavement markings are to be placed and maintained at all railroad and light rail grade crossings on State highways, including spur tracks.

Railroad grade crossing pavement markings shall also be placed in each approach lane in advance of every light rail grade crossing where automatic gates or flashing lights are present.

### **M1.19 Miscellaneous Markings**

Instructions for proper placement and stencil design for the following markings are found in the MUTCD and the CA Supplement:

- (A) Speed Enforcement by Aircraft
- (B) High Occupancy Vehicle Lanes
- (C) Bike Lane Markings
- (D) Disabled Persons Parking Symbol
- (E) Cattle Guard Crossings  
(Work on cattle guard crossings is to be reported to “C” Family, Slopes/Drainage/Vegetation).

### **M1.20 Material**

All pavement delineation materials used to guide or control vehicular and pedestrian traffic on the State highway system shall be approved by the Engineering Service Center, Office of Materials Engineering and Testing Services. Test sections of new materials may be placed with concurrence of Headquarters Division of Traffic Operations.

### **M1.21 Traffic Paint**

The paint currently used for pavement delineation is water-borne, and is available in white, yellow, and black.

Traffic paint is available in bulk containers called “totes” (approximately 345 gallons), 55 gallon barrels, and 5 gallon buckets.

Waterborne paint should not be stored where it may be exposed to repetitive freeze/thaw cycling.

When water-borne traffic paint is used, two (2) coats of paint are not required, except on chip seals.

For chip seals, one (1) coat of paint shall be applied in each direction of travel. Both coats shall be beaded. Care should be exercised that recommended application rates for water-borne paint are not exceeded. Applying water-borne paint too heavily will cause the paint to chip.

	Gallons Per Mile			Pounds per Gallon of Applied Paint
	First Painting, New Surface		Re-striping	Glass Beads
Delineation	First Coat	Second Coat	All Coats	All Coats
Broken Stripe	3-5	4-6	4-6	6-8
Solid Stripe	6-8	10-12	10-12	6-8
Pavement Markings	Light Application to seal pavement	1 gallon per 107 sq.ft.		6-8

Deviations from recommended application rates may occasionally become necessary to accommodate local conditions such as tracking, temperature, etc. Decisions to adjust application rates should be based on the supervisor's knowledge of local conditions, experience, and best judgment.

To achieve maximum service life from the painted traffic stripe, striping operations should normally be conducted when weather conditions conform to the following ranges of temperature and humidity. Water-borne paint should not be applied when the ambient temperature is below 50° F (10°Celsius) or when relative humidity exceeds 75 percent.

### **M1.22 Hot Melt Thermoplastic**

Thermoplastic materials are the preferred pavement delineation and marking materials for all areas that are not regularly plowed for snow or mud and where the pavement is in good condition.

Thermoplastic is supplied in two generic types, depending on the type of base resin used. The 2 types, hydrocarbon and alkyd, are not compatible in the application equipment and must never be mixed. Although alkyd and hydrocarbon materials will fuse to one another on the road, they are incompatible in a melting kettle. Failure to completely clean out kettles during material change-over may cause severe equipment problems.

Both types of thermoplastic are available in granular form for spray, ribbon, or extruded application. Thermoplastic is a dry blended mixture of resins, pigments, fillers, and glass beads packaged in a meltable plastic bag.

Thermoplastic for traffic stripe is available in white or yellow colors.

Thickness of thermoplastic may be reduced to achieve a better cost-effectiveness when used on pavement surfaces having a short life expectancy. The recommended minimum application rate of extruded thermoplastic is 80 mils.

### **M1.23 Cold Pre-Formed Plastic Tape**

Plastic tape comes as a complete stripe or pavement marking legend ready to be applied to the road. It may be surface applied, recessed, or rolled into the pavement on new asphalt paving projects.

This material may be considered for locations where use of tape may be cost effective compared to other alternatives. Cold weather application of tape is generally not recommended and pavement temperatures should be at least 50°F (10° Celsius). Manufacturers' instructions for allowable temperature ranges should be followed.

### **M1.24 Thermo-Applied Granular Striping System**

This material is no longer available.

### **M1.25 Pavement Markers**

Pavement markers are available in various configurations and may be surface mounted (raised) or recessed. Markers can be retroreflective or non-reflective, temporary, or permanent, and can be installed using either epoxy or bitumen adhesives. All pavement markers used must be pre-approved by Headquarters Division of Traffic Operations and tested for compliance with specifications by the Office of Materials Engineering and Testing Services.

The allowable ambient temperature range for pavement marker installation varies with the type of adhesive being used. When using bitumen adhesive, it is important that adhesive temperature during application be between 375° F (190.6° Celsius) and 425° F (218.3° Celsius).

The use of epoxy adhesive requires that traffic control be maintained for protection of the marker until the final set of epoxy takes place. This may require as much as one (1) hour of cure time. The 1:1 mixing proportion of epoxy components must be carefully controlled to achieve the best bond between the pavement surface and bottom of the marker. Minor deviations can seriously increase marker loss.

Markers of approved colors may be placed by other agencies to identify locations of special facilities such as water sources for fire protection. Permits are required for such installations.

## **M1.26 Surface Preparation**

### **(A) Paint**

A mechanical sweeper may be used prior to paint application to remove debris from road surface. This operation may or may not be necessary, depending on amount of dirt/debris on the roadway surface. On new Portland Concrete Cement (PCC), mechanical wire brush or abrasive blasting must be used to remove curing seal and other foreign material. Use of an air line (duster) mounted in front of the paint guns on the striper has proven successful in removal of dust.

Care must be taken not to use too much air and overwork the compressor. It is an unacceptable waste of Maintenance resources to place paint or other delineation materials on areas where dirt, debris, or weeds prevents adherence of such materials to the roadway surface.

### **(B) Pavement Markers**

Both PCC and asphalt concrete (AC) road surfaces should be clean and dry before application of adhesive. This is especially important on new PCC pavements. The contact area for markers placed over existing paint must be either abrasive blasted or the paint must be well worn to achieve a satisfactory bond.

Pavement delineation materials shall not be applied in wet weather.

## **M1.27 Inventory Updating**

Contact your District IMMS Coordinator for information about inventory updating.

## **M1.28 Supplemental Information**

### **(A) Guidance from District Traffic Operations**

District Traffic Operations should be responsible for providing to Maintenance, current standards that can be carried on each striper and marking truck. Supervisors are responsible for assuring that the latest standards are available for performance of work. Any change in stripe or marking patterns must be in writing and approved by District Traffic Operations.

(B) Equipment Needs

Specialized equipment is required for work performed by pavement delineation crews.

The Equipment Catalog should be reviewed before submitting requests for new or replacement equipment.

## **Section 2 - Signs (Family Problem M4)**

### **M2.00 Introduction**

This section covers the maintenance of permanent signs placed on the State highway system for the purpose of warning, regulating, or guiding traffic, and is broken down as follows:

M2.01 to M2.04	General Information
M2.05 to M2.14	Sign Panel Information
M2.15 to M2.23	Sign Support Information

The Traffic Manual has been replaced by the Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) as amended by the most current version of the California Supplement to the MUTCD (Supplement), herein referred to as the MUTCD and the CA Supplement. Contact the Division of Traffic Operations or the Division of Maintenance for additional information or advice on the MUTCD and the CA Supplement. Attention is directed to the Division of Traffic Operation homepage for the Office of Signs, Markings and Permits.

Signs referenced with (CA) in this chapter indicate a California sign code. Otherwise, the sign code referenced is a Federal sign code.

## **M2.01 Scope of Chapter**

Typical sign work may include the following:

- (A) Placing of posts and/or signs.
- (B) Identification of damaged or inadequate signs.
- (C) Initiation of the reordering process for replacement signs.
- (D) Preparation of accident damage reports.
- (E) Painting of steel structures supporting overhead signs.
- (F) Tightening of bolts and screws.
- (G) Assembly of sign panels for temporary use in place of badly damaged signs.
- (H) Cleaning of dirty signs.
- (I) General inspection duties.

## **M2.02 Levels of Maintenance**

Levels of Maintenance, including frequency and priority of action, are included in Maintenance Manual Volume 2, “M” Family, for budgeting purposes. Levels may vary depending on overall appropriation of funds by the Legislature. Signs not properly maintained present a poor appearance and have diminished effectiveness in authority as traffic control devices.

Periodic inspection to detect deficiencies, which require corrective action, is an important part of proper sign maintenance.

In general, signs critical to traffic safety or operations should be repaired or replaced promptly.

If prompt corrective action is not possible, a temporary sign should be installed until permanent repair or replacement can be made. Sign deficiencies not critical to traffic safety or operations should be taken care of as soon as practicable to prevent the loss of capital investment.

Sign inspection may be performed during daylight hours or at night. Effects of age, weathering, and vandalism are sometimes difficult to detect unless the sign is observed at night. A night check should be made immediately following a grass or range-land fire as heat can cause loss of retroreflectivity.

A formal night inspection of all traffic signs shall be completed once each year. If specifically requested, results are reported to the Headquarters Division of Maintenance. When reports are not requested, the records should be kept on file for a minimum of three (3) years. Routine or informal sign inspections are performed on an "as-needed" basis, or under the general guideline of twice a year. Informal sign inspections are not reported to the Headquarters Division of Maintenance.

The supervisor of the sign crew, or the "sign person" where sign crews do not exist, shall have the primary responsibility for detecting and reporting sign deficiencies. However, all employees should be instructed to report damaged, non-performing, or obscured signs whenever noted.

District Traffic Operations may also aid in determining the adequacy of signs.

The following are general guidelines for performing sign inspections at night:

- (A) It is important that the inspection vehicle headlamps be properly adjusted. Headlamps should be in the dimmed position for night sign inspection.
- (B) Conduct inspections safely. Try to blend with the flow of traffic. If it is absolutely necessary to slow or stop on the shoulder close to the traveled way, use a flashing light, amber rotating light, or light bar. A hard hat and retroreflective vest shall be worn if the sign inspector leaves the inspection vehicle. Retroreflective material on the hard hat is optional. Please refer to the current Code of Safe Operating Practices (COSP) for required and suggested personal safety equipment for night work.
- (C) The inspection team usually consists of two (2) or three (3) employees. One member of the team should be a qualified sign Maintenance person. District Traffic Operations employees should be invited to participate.
- (D) It is not necessary that inspectors have good visual perception. It is necessary, however, that at least one team member have good color vision for evaluating sign colors.

Decisions regarding the adequacy of borderline signs should be based on the combined judgment of the team.

- (E) Signs should be observed at the "distance of driver need." This distance varies depending on factors such as average speed and roadway alignment. However, for the average highway, observations should be made 250 ft. to 500 ft. in advance of the sign. For city streets, where average speeds are generally lower, sign observations may be made closer to the sign.
- (F) The inspection vehicle should normally be driven in the outside lane of multilane highways. This is generally the safest path of travel for the night inspection team. It also places the team in a position where signs hidden by vegetation will be noted. The team should not park on the shoulder to evaluate retroreflectivity of a sign unless such practice is necessary for reasons of safety (shoulder mounted signs appear brighter when viewed from the shoulder than when viewed from the traveled way).
- (G) Median mounted signs may be observed from the number one lane if it is safe to do so.
- (H) It may be necessary to make two inspection passes for sections of highway where both median mounted and shoulder mounted signs are to be observed. R1-1 STOP signs and W3-4 STOP AHEAD signs on county road approaches to State highways shall be checked.
- (I) Do not use a spotlight to evaluate night sign retroreflectivity. The spotlight is several times brighter than vehicle headlamps. This causes false observations of sign brightness.
- (J) The adequacy of sign retroreflectivity is not based on specific levels of brightness. Rather, it is based on the best judgment of the night inspection team. Typical factors to consider when making decisions regarding sign adequacy are:
  - (1) Whether the sign is difficult to see because it is in front of a lighted background (as may be the case in urban areas).
  - (2) Whether there is competition for driver attention in the area of the sign. If the answer to either of these questions is "yes", a brighter sign may be needed at those specific locations.
  - (3) The "degree of hazard" associated with the sign message.

The sign condition report for signs needing work must be completed accurately to assure that appropriate corrective action will be taken. Budgeting, staffing, and work scheduling are typical uses of reported data.

Signs that are not adequate because they are dirty or hidden by vegetation should not be reported as deficient. These signs should be noted and reported to the appropriate Maintenance Supervisor for action. Trimming or removing vegetation or relocating the sign are corrective action alternatives for hidden signs. Sign relocation requires approval of the District Traffic Operations unit.

In addition to general physical inspections of overhead signs by sign Maintenance personnel, an engineering inspection of overhead sign structures should be made at least every five (5) years. The engineering inspection includes all portions of the structure, safety devices, mechanical and electrical equipment, and other items which need attention.

Maintenance effort on major changeable message signs (permanent type) is reported to the “K” Family, Electrical. Required maintenance on steel sign structures supporting those signs are reported to the “M” Family. Small changeable message signs that are turned or opened by hand for viewing are reported to the particular Family requiring use of the sign.

### **M2.03 Reporting Requirements**

Only permanent regulatory, warning and guide sign needs are to be reported to the M4 Family for recording in the Integrated Maintenance Management System (IMMS). All operational snow signs (signs within roadside rests, park and ride lots, weigh stations, etc.), and construction zone signs are to be reported to the appropriate Family in the IMMS. Electrical work on signs is to be reported in the “K” Family. Complete Charging practice instructions for all Families can be found in Maintenance Manual Volume 2.

The Division of Maintenance has established “Activities” by Family identifying types of work performed, units of production, costs of work, and any Special Designation or Project Code requirements. Management decisions are often based on analyses of the coded entries. Therefore, special care should be taken to assure that the coded information entered by Maintenance personnel in the IMMS is accurate.

Sign Maintenance funds must, by statute, be used for replacement or maintenance of signs.

When a sign is replaced, the new sign must essentially be the same as the one it is replacing to qualify for Maintenance funding. New installations, if performed by Maintenance, or replacement signs that are new in shape, size, or message, are upgrades, and shall be charged to improvement allocations. These must be authorized by an Installation Order issued by District Traffic Operations.

## **M2.04 Responsibility**

Permanent signs should be installed by persons who are trained for that particular work. Sign materials are relatively delicate and are easily damaged.

An untrained person may not know proper methods of transporting or displaying sign messages, protecting sign materials, or using equipment to safely complete the installation.

New installations, with the exception of temporary emergency signs, are not to be made without approval of District Traffic Operations unit. Temporary signs required by unusual conditions or restrictions may be installed without an installation order from the District Traffic Operations unit. However, such temporary signs shall be removed or covered immediately when those conditions cease to exist or restrictions are withdrawn.

Installation Orders should show location of the sign, type of sign, type of material, type of support, size of letters, and color. Questions regarding IOs should be directed to District Traffic Operations unit.

The Office of Structures Maintenance and Investigation, Division of Maintenance, is responsible for keeping an inventory of overhead and changeable message signs and providing periodic engineering investigations. Sign numbers in the overhead sign inventory are assigned by the district. The district is responsible for maintenance of overhead signs and sign structures including both routine and special work recommended by the Office of Structures Maintenance and Investigation.

A significant amount of sign damage occurs in mountain areas due to snow removal activities. It is important that this type of damage be minimized. Unnecessary damage that requires repair or replacement of signs causes waste of Maintenance resources.

It is general policy for the Department to install and maintain permanent signs on State highways within incorporated cities or counties. When possible, districts should delegate the installation and maintenance of warning and regulatory signs to cities and counties equipped to do the work.

However, the responsibility for assuring that these signs are adequately maintained remains with the State.

Maintenance of "Trailblazer" signs, which direct traffic on city or county streets and roads to the State highway system may be performed by local jurisdictions or with State forces. Caltrans, however, has the ultimate responsibility for maintenance of such signs placed by the State off the highway system.

The Department will normally not install or pay for the installation of parking regulatory signs within cities or counties. These signs are usually placed to inform the motoring public of ordinances and police regulations within the local agency and may have little to do with operation of the State facility.

The Department is frequently called upon to install signs for private parties, including STOP signs for subdivisions, directional signs for golf clubs, and so forth. Other State agencies, cities and counties also request signs. All such requests are referred to District Traffic Operations. An encroachment permit will be required before work is performed for or by others. Costs are billed to the requesting party.

Maintenance of signs placed off the highway right of way may be an obligation of the Department when the sign is primarily placed for protection of traffic on the State facility. Examples are the R3-1 STOP AHEAD signs placed on roads approaching the State highway. It is standard practice for Caltrans to fund the initial installation and future maintenance of such signs for existing road connections, after obtaining necessary permission from the local agencies involved.

Where a new entrance to a State highway is provided under an encroachment permit, the other agency will be responsible for initial installation of the signs. The signs will be maintained by Caltrans in the future.

Districts are responsible for the placement and maintenance of limit lines (stop bars) at both existing and new paved approaches to a State highway. A STOP pavement marking should also be placed and maintained when directed by the Traffic Branch. Districts will coordinate the work of the sign and stencil crews for these installations.

Any unauthorized sign placed on the highway right of way by a private organization or individual constitutes a public nuisance and shall be removed.

Before relinquishment of any State route to a local agency, all signs must be in good repair.

Statutes providing for relinquishment exempt only the U.S., interstate, county, and State route shields that are to be removed prior to the time the route is actually turned over to the local authorities.

### **M2.05 Sign Acquisition**

Signs listed in the Material Operations Warehouse Catalog shall be ordered through the Material Management system on a Local Request, EDP Form DAS-OBM-1001C.

Special signs, not listed in the catalog, should be ordered on a Purchase Request, Form DAS-OBM-1005 in accordance with current instructions. Except for signs placed in stock, District Traffic Operations is responsible for ordering most signs.

Attention is directed to emergency clauses in sign procurement contracts, which are available from District Sign Coordinators. Sign orders may specify either a 5-day or a 21-day emergency order. Signs made under this provision will be direct shipped to the ordering district. Under emergency orders, the sign manufacturer will make and ship signs within 5 days (or 21 days) upon receipt of a valid Purchase Order. Allow for additional time to cut Purchase Orders and transit time after signs leave the manufacturing plant. The State is charged 15 percent and 10 percent more respectively for 5-day and 21-day emergency orders. Except for temporary and emergency signs, there is minimal need, if any, for Maintenance personnel to fabricate signs.

### **M2.06 Selection of Signs**

The broader use of symbol signs, in preference to word messages, is desirable. Educational plates accompany some symbol signs to explain in words the meaning of the new symbol.

Unless otherwise directed by the Traffic Branch, educational plates should remain in place for at least three (3) years after initial installation. No special effort will be made to remove educational plates as long as they are in serviceable condition.

Signs placed on State highways must comply with provisions of the Vehicle Code and other Statutes. The basic requirements of a highway sign are that it be legible and understood in time to permit a proper response.

Only warning, regulatory, or construction signs may be supplemented by flashing beacons.

### **M2.07 Classifications of Signs**

Highway signs are grouped into four general classifications: Warning, Regulatory, Guide, and Construction (a.k.a., Temporary Traffic Control or TTC signs). Designated shapes and colors are used to differentiate between the different sign classifications. Persons installing signs must make certain that the distinctive silhouette shape of a sign is not blocked by other signs mounted above, below, along side, or behind the sign. Other signs shall not be mounted back-to-back with the R1-1 STOP or the R1-2 YIELD signs.

All classifications of signs shall be retroreflective and/or illuminated to show the same shape and color day and night. The MUTCD and the CA Supplement contain detailed information on signs and sign policies. All persons installing signs should have available, a copy of Part 2 and Part 6 of the MUTCD and the CA Supplement for ready reference. The Uniform Sign Chart is a listing of some of the more common signs.

A copy of the Uniform Sign Chart should be in every sign truck. The Uniform Sign Chart is available from the Office of Signs, Markings and Permits web site. In addition, the web site has links to traffic sign specification sheets (Caltrans and federal) that contain detailed layouts and dimensions for all signs. Installation details are shown on Standard Plans RS1 to RS4. Typical plans and locations for signs and pavement markings are shown in the MUTCD and the CA Supplement.

**(A) Warning Signs**

Warning signs are placed to alert drivers, pedestrians, bicyclists and other road users to road conditions, which may not be reasonably apparent to, and may not have been anticipated by, a person exercising due care and diligence. Maintenance and/or replacement of warning signs should have top priority over all but a few types of regulatory signs.

Warning signs are generally diamond shaped with black legend and border on a yellow background. Exceptions are the railroad crossing sign (round), the symbolic school crossing sign, changeable message signs, and the rectangular shape used for supplemental signs (such as advisory speed signs) mounted below and on the same post with other warning signs.

Warning signs set up specifically for construction zones shall have a black legend and border on an orange reflective background.

**(B) Regulatory Signs**

Regulatory signs are used to inform drivers, pedestrians, bicyclists and other road users of regulations that apply at definite locations, specific times, or where the regulations are not self-evident. This group includes signs regulating the movement, speed, stopping, or parking of vehicles. Regulatory signs are generally black and white or red and white.

The general shape of a regulatory sign is rectangular. The shape of a stop sign is an octagon and a yield sign is an inverted triangle. Two signs for different purposes should not normally be mounted on the same post.

The R5-1 DO NOT ENTER and the R4-1 DO NOT PASS signs are examples of regulatory signs which have high priority for early replacement or maintenance.

**(C) Guide Signs**

The purpose of guide signs is to provide directional, route, recreational, and roadside service information. Guide sign colors are generally green, blue, or brown with white legends and border.

The priority for maintenance or replacement of guide signs, depends on the needs of road users in a particular area.

Flashing lights or distracting legends shall not be placed on guide signs.

Unless otherwise approved by District Traffic Operations, a minimum spacing of 200-ft. between guide signs shall be maintained on conventional highways.

A minimum spacing of 800-ft. should be maintained on freeways and expressways.

**(D) Colors of Construction and Maintenance Work Zone Signs (i.e., Temporary Traffic Control Signs)**

These signs are used to caution motorists in advance of (and through) work zones. The colors for regulatory signs in work zones shall follow the standards for regulatory signs in Table 2A-4 and Chapter 2B of the MUTCD and the CA Supplement. Warning signs in work zones shall have black legend and border on an orange background, except the W10-1 Rail Road Crossing sign shall have a yellow background. If additional temporary guide signs are used in work zones, they shall have black legend and border on an orange background. The contractor should remove all temporary traffic control signs at the end of a project. In maintenance work zones, Maintenance crews should remove all temporary traffic control signs when the work is complete.

All work zone signs shall be retroreflective when used during the hours of darkness.

Fluorescent orange or orange colors may be used in work zones for temporary warning signs and temporary guide signs. Retroreflective fluorescent orange or retroreflective orange signs may be used day or night. Fluorescent orange signs or orange signs that are not retroreflective shall only be used during daylight hours. Fluorescent orange is a color and is not a substitute for retroreflectivity. Fluorescent orange appears brighter than orange in daylight and is more conspicuous during twilight hours. Fluorescent orange appears orange at night. Fluorescent orange and orange should not be mixed in the same work zone. Signs should be all fluorescent orange or all orange in the same work zone.

## **M2.08 Sign Materials**

All new materials used for traffic signs, must be approved by the Traffic Devices New Products Committee.

This committee evaluates products before general use to assure that proposed materials provide adequate performance. In cooperation with the Office of Materials Engineering and Testing Services, the committee also evaluates the service life potential of new products. The Office of Structure Design, Division of Structures, is responsible for structural design of the sign and supporting structure.

Materials used in the manufacture of signs serve three basic functions:

- (A) Sign substrates provide stiffness as well as a suitable surface for background materials such as retroreflective sheeting. Most current sign substrates are a single thickness of aluminum. Other substrates use aluminum sheet for front and back surfaces with a paper core between, forming a "sandwich" type laminated panel. Steel was used as substrate material for many of the older overhead signs. Substrates such as plywood may be used for special applications but are not approved for general use.
- (B) Sign background provides a colored surface, which contrasts with the sign, message (legend) and border allowing road users to clearly read and understand the meaning of the sign message. The background also serves to attract attention of road users. Background colors are coded to explain the primary purpose of the message. Background materials for all warning, regulatory, guide and construction signs are made of retroreflective sheeting.
- (C) Sign legends convey the message while borders outline the message making it more visible to road users. Sign legends and borders are retroreflectorized for most guide, service, and recreational signs. Warning, regulatory and construction signs generally utilize black non-reflectorized, legends and borders.

The following notation is usually stamped on the lower right side of the back of each sign:

1. PROPERTY STATE OF CALIFORNIA,
2. Name of the sign manufacturer,
3. Month and year of fabrication,
4. Type of retroreflective sheeting, and
5. Manufacturer's identification and lot number of retroreflective sheeting.

Signs having graffiti protection are sometimes marked with a 3/8<sup>th</sup>-inch dot. It is a black dot on white border or white dot on black border. The dot is placed on the lower border of the sign before application of the graffiti protection. The application method and exact location of the dot may vary depending on the manufacturer of the sign.

### **M2.09 Storage and Handling of Signs**

Sign materials can be easily damaged by improper storage or careless handling.

It is important that signs and sign supports be protected in storage and transporting as well as during and after installation. The supervisor is responsible for assuring that signs are handled with proper care at all times.

Proper storage techniques prevent damage such as scratching of sign surfaces or warping of wood sign supports. Although proper storage is generally a matter of using common sense, certain types of sign supports and signs may require special storage techniques. Direct inquiries regarding special storage requirements to the Office of Materials Engineering and Testing Services.

Transport and store sign panels in a manner that protects the face from damage. Protect signs by wrapping, tarping, or other methods to ensure that weather and movement during transit do not damage the face. Keep signs dry during transit and ship on pallets, in crates, or tier racks. Place padding and protective materials between signs as appropriate.

Store signs in a dry environment at all times. Do not let signs rest directly on the ground or become wet during storage. Maintain signs in a freestanding position whether stored indoors or outdoors. When stored outdoors, maintain 4-inch minimum spacing between signs. In areas of high heat and humidity, do not store signs in an enclosed non-climate-controlled trailer or container. Store signs indoors if duration of the storage will exceed 30 days.

Laminated panel signs normally have small weep holes in the channel at the bottom edge. This allows moisture that enters the panel from bullet holes and other damage to drain, thereby preserving the sign's structural integrity.

If the panel is stored upside down or if it is reused and installed upside down, the weep holes allow water to enter the panel rather than helping drain accumulated water. Any unneeded holes observed in laminated panel signs should be plugged or sealed to prevent moisture intrusion. Storage of signs in vehicles used by sign crews is of special concern. Rubbing and marring of surfaces of on-board signs is caused by vibration of the vehicle during travel. A sign can be seriously damaged in this manner before it is installed.

Signs carried in a sign repair vehicle should be kept to the minimum number and types necessary to adequately respond to short-term needs. Do not permit retroreflective sheeting signs to rub against each other or against abrasive parts of the sign repair vehicle.

Proper storage of wood sign supports in Maintenance yards is important. Sign posts stored flat on the ground or on asphalt can be warped beyond use. Care should be taken to support wood posts above ground level. This reduces warping and cracking by allowing air to circulate providing more uniform moisture and temperature conditions around the sign supports. Refer to Section M2-19 for storage of laminated box-beam sign posts.

Treated wood posts must be stored under cover or tarped to prevent chemical runoff from entering drainage systems. Special care is needed in storage and transporting large signs to prevent warping the entire sign structure, marring the sign surface, or bending edges. Large signs should be stored on edge rather than flat. Flat storage can cause warping and entraps moisture, which often damages sign materials. When stored on edge, it is important that the edge of one sign is not bearing directly against the face of an adjacent sign. Sign edges can easily damage retro-reflective sheeting.

## **M2.10 Installation of Signs**

Installation of signs should be a carefully planned activity. Good planning improves efficiency of the installation procedure, minimizes interference with the traveling public, and assures that potential safety problems are considered.

An important part of the planning process for installing signs is determining the location of underground and overhead utilities. Prior to digging, supervisors shall notify utility companies of intended work through Underground Service Alert (USA), as outlined in Chapter 1 of this Manual, Section 1.27. Serious accidents can result if this step is overlooked. Exercise care when digging in landscaped areas to avoid buried water lines.

Current details for the location and position of signs are available in the Standard Plans and in the MUTCD and the CA Supplement. These details are periodically updated and field crews should make sure they have the latest plans when maintaining signs.

The desired result of the sign installation process is that signs effectively communicate information to road users. Placement of signs along a highway should be spaced to allow road users time to assimilate the message. Spacing should be determined in "Units of Time" based on the expected approach speed.

The following general rule is good practice:

If possible, signs should be at least 500-ft. apart. A desired minimum spacing for Guide Signs is 800-ft. on freeways and expressways, and 200-ft. on conventional roads. District Traffic Operations should be contacted to resolve questions about location or position of a sign.

Sign installation can be as simple as digging a hole for a small one-post roadside sign, or as complex as mounting large multi-panel signs on overhead sign structures. In either case, use care to avoid damaging the sign while handling. Retroreflective sheeting is easily damaged when pressure is applied to the face of the sign during installation. The sign might look good in daylight, but the damaged section will appear blacked-out at night. In a multiple-post installation, install posts before the large sign is installed. This will reduce possible damage to the signs. Use fixtures that have been specifically designed for sign handling.

Proper installation procedure is important to ensure long-term service life. Position post holes correctly. The bottom of holes for wood posts should be wetted, tamped, and leveled before posts are installed. In all cases, signs should be level and posts should be plumb.

Safe work practices, including wearing gloves and hard hats, safety glasses and other equipment as necessary to avoid injury to sign crew members. Supervisors should regularly review the appropriate Maintenance Codes of Safe Operating Practices with their crews.

Different sign support systems require different hardware and installation procedures. Hardware is approved for use based on testing procedures designed to assure maximum safety for the motorist. Maintenance personnel shall not use alternate hardware without prior approval of the Division of Maintenance.

Large ground-mounted signs cost several thousand dollars each. Preventable sign damage is an unnecessary drain on Maintenance resources.

Districts should take action as follows to reduce preventable sign damage to the greatest extent possible:

- (A) Identify large signs that may be subject to damage from careless drivers. Damage usually occurs when the lower left corners of these signs are hit by large, slow moving vehicles.
- (B) If feasible and economical, districts should consider relocating such signs during scheduled maintenance replacement work.

- (C) When relocation is not feasible, a guide marker (delineator post) may be installed in alignment with and in advance of the sign in a position that may keep vehicles from hitting the sign. These markers should be retroreflectorized only where such installation will not diminish the effectiveness of existing roadside guide markers (to the extent of confusing the motorist).
- (D) Any measures taken to prevent damage to ground-mounted signs must be consistent with the policy of providing a safe roadside environment. District Traffic Operations should be contacted for approval of any unusual measures that may be necessary to protect signs from vehicular damage.
- (E) When replacing either damaged guide or regulatory signs, consider relocating these signs where they will be less susceptible to damage. This may mean that some signs will be located in less than the ideal position. Written authorization must be obtained from District Traffic Operations before any significant relocation of a sign.
- (F) Landscape irrigation systems are another source of sign damage. Water spots, streaking, loss of retroreflectivity and corrosion can result from sprinkler heads directing water onto the sign panels. In addition to damage to the sign panels, wood sign posts (especially laminated wood sign posts) can be severely damaged by repetitive spraying from landscape sprinkler systems.

Damage can be eliminated or reduced by making minor field adjustments to the sprinkler system to avoid spraying adjacent sign panels and wood posts. It may be necessary to move the signs to another location.

- (G) Nonstandard installations may be justified where special circumstances exist.
  - (1) Damage to signs can be reduced in heavy snow removal areas by modifying normal installation procedures. Laminated panels may be offset so the overhang on the roadside edge is reduced. In addition, laminated panel signs should be ordered in the 2-½ inch thickness to provide the stiffness necessary to resist snow loads. This has proven effective in reducing the number of signs damaged during snow removal activities.
  - (2) Upon request, District Traffic Operations can reduce the size of a sign by "stacking the message" thereby reducing the surface area exposed to the elements.
  - (3) Single sheet warning and regulatory signs, may be reinforced, by backing the new sign, with a salvaged aluminum blank. The new sign can be riveted to the salvaged sign to obtain greater stiffness.

- (4) One-post directional signs for installation within sidewalk areas of cities and towns should generally be ordered for off-center installation. The post, located at the left-hand edge of the sign face, may then be placed near the curb where it will not interfere with pedestrian traffic.
- (5) Two-post signs are more difficult to install in sidewalk areas. When necessary, one post should be placed at or near the curb line with the second post at or near the property line. The sign may then be mounted on 2 in.x 4 in. lumber placed horizontally between the posts. Property owners have objected to this type of installation, and it should only be used when a sign is too long for one-post mounting.

### **M2.11 Sign Maintenance**

No definite rule has been established to determine when a sign is damaged beyond repair or when a sign should be repaired and retained in service. In general, a sign should be replaced if it cannot economically be repaired to present a neat appearance. Sign Maintenance personnel should rely on experience. Historical data and best judgment to arrive at cost-effective decisions regarding sign maintenance.

Washing or cleaning signs is a proper sign maintenance activity, but only if it is cost-effective.

In certain situations, the better alternative may be to replace rather than wash or clean a sign.

Special Programs People may be used to make washing signs a cost-effective alternative to replacement.

Specific methods and materials are recommended for repairing different types of signs.

Questions regarding materials used for repairing and cleaning signs should be directed to the Office of Materials Engineering and Testing Services. This is especially important with regard to retroreflective sheeting signs because the sheeting surface is easily damaged by use of improper cleaning agents. Questions regarding specific methods of sign installation or maintenance may be directed to the Division of Maintenance.

The variety of tasks involved in the maintenance of signs means that districts must exercise judgment to arrive at cost-effective choices in terms of how best to utilize available Maintenance resources. Ultimately, the districts are responsible for making proper, cost-effective decisions regarding sign maintenance.

### **M2.12 Hidden Signs**

Landscape plantings maturing along many miles of highways have increased the number of signs that are obscured. Signs hidden by natural vegetation or designed landscaping are of no benefit to the motorist. Corrective alternatives should be considered in the following order when signs are hidden:

- (A) Is the sign necessary? (Check with Traffic for guidance).
- (B) Can the sign be economically moved to a better location?
- (C) Is it feasible to trim vegetation to the extent that the sign can be seen?
- (D) If periodic trimming has been necessary, would removal of the tree or other vegetation be a better alternative?

Occasionally, signs may be hidden by other signs, or sight restrictions, such as cut slopes or buildings. Notify the District Traffic Operations unit when this occurs for direction regarding appropriate corrective action.

### **M2.13 Obsolete Signs**

Periodically, some signs are eliminated, or changes are made in messages, designs, sizes, or colors. The result is that existing signs become obsolete, even though they may adequately serve the intended purpose for many years. Unless otherwise directed by Traffic Operations, such signs should remain in service until normal maintenance replacement is required. Directed replacement of signs before the end of normal service life is considered "betterment", and such costs must be from capital improvement funds.

Obsolete signs in inventory that have not yet been installed should be returned to a Material Operations warehouse for disposal.

Due to the adoption of the MUTCD and CA Supplement, a number of signs have been designated as obsolete, and target dates to remove and replace these signs have been established by Traffic Operations. Please refer to Figure I-101 entitled California Signs With Target Compliance Dates for current listing of obsolete signs in 01/06/05 TCD Target Dates to CTCDC at: <http://www.dot.ca.gov/hq/traffops/signtech/signdel/policy.htm> for a full listing of these signs. Direct all questions about these signs to District Traffic Operations. Speedometer check signs are being phased out. When a speedometer check sign in a series of speedometer check signs is damaged, that sign and all others in that series should be removed, eliminating the installation.

## **M2.14 Temporary Signs**

Temporary signs shall be maintained only as long as the need for that sign exists. When the need no longer exists, temporary signs shall be removed or covered completely. It is not acceptable practice to cover the sign message only.

Temporary signs shall have a retroreflectorized background and/or legend and border depending on the standards for that particular sign. Temporary signs shall also conform to the color, size, material, and other requirements, which apply to permanent signs of that type, unless otherwise specifically authorized in writing by District Traffic Operations. Depending on the type of sign and expected usage, the service life of temporary sign materials may be somewhat less than that used for permanent signs.

Districts shall keep an adequate inventory of materials available for immediate fabrication of emergency signs.

## **M2.15 General Sign Support Information**

Types and sizes of ground-mounted sign supports should be initially chosen on the basis of:

- (A) Safety in the event of a hit by an errant vehicle.
- (B) Ability to withstand a "blow down" in heavy wind, depending on the size of the sign.
- (C) Cost analysis considering both the initial cost of the support and the ongoing, future cost of maintenance.
- (D) Aesthetics or compatibility with surrounding features.

Current Statutes prevent the use of Maintenance funds for upgrading posts (bringing existing posts to current standards). However, districts have the option of reviewing each sign location using future maintenance costs as a criterion for recommending a change in type of sign support.

With proper documentation and concurrence of District Traffic Operations, the type of support can be changed to provide a more cost-effective installation when replacement is warranted. Safety of the public shall always be included in such a review.

Holes shall not be drilled in light standards for the purpose of installing signs. Signs at these locations shall be banded to the post using standard hardware designed for this purpose.

Hidden depressions resulting from post removal present a hazard to workers and should never be left unfilled when installations are abandoned. Make contractors and permit holders aware of the problem.

### **M2.16 Wood Posts**

Dimensioned wood posts have long history of success as sign supports for smaller ground-mounted signs. Wood posts may still be the most cost-effective installation, especially in locations where it is unlikely they can be hit (e.g., behind guardrail). Unless conditions otherwise dictate, the wood post is the primary sign support structure used.

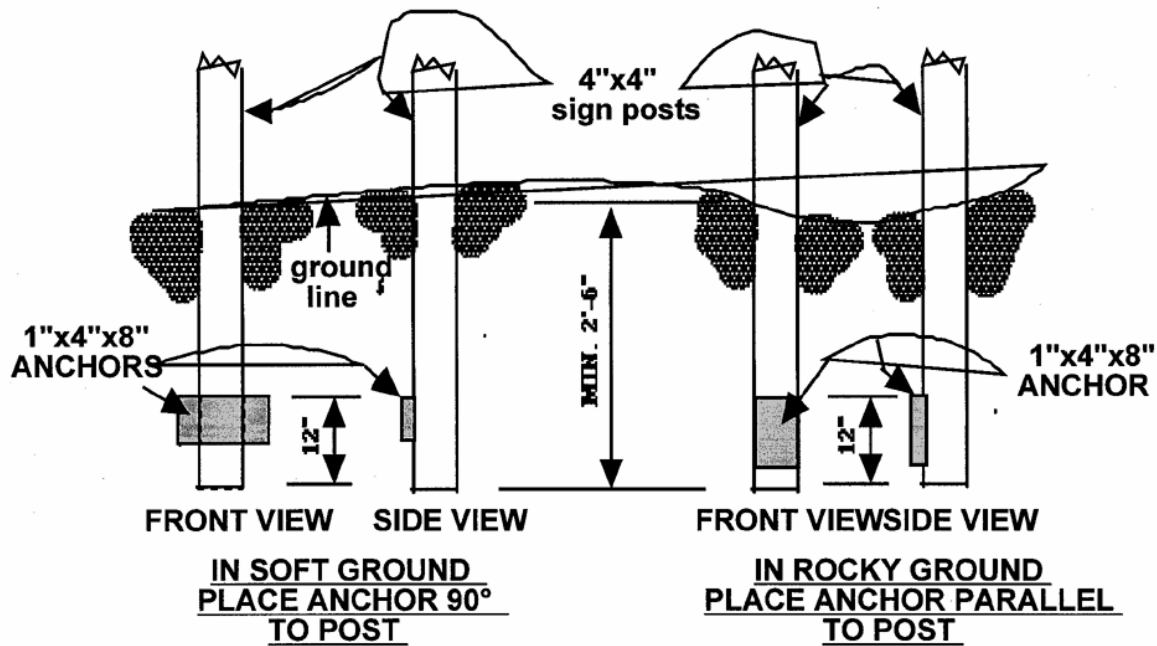
Where needed, holes are to be drilled in the larger wood posts to provide a weakened plane for breakage when the post is impacted by a vehicle. It is important to make sure the holes are drilled at the specified height above the ground. The holes are placed at this height so the broken end protruding above the ground will not snag the bottom of a car. See current Standard Plan sheets for details on hole locations.

Anchor blocks may be used on wood posts where signs are located in soft ground, near schools, and at locations frequently used by pedestrians. The anchor blocks prevent the sign from being rotated in the hole, lifted out, or stolen.

Wood sign posts shall not be painted.

When handling treated wood posts, skin contact shall be avoided. Wear long sleeved shirt and gloves and avoid breathing wood dust when sawing or drilling posts.

### ANCHOR BLOCKS FOR WOOD SIGN POSTS



#### M2.17 Steel Posts-Small Signs

Several patented breakaway metal post systems for small signs have been approved for operational use. The use of breakaway metal post systems has both advantages and disadvantages.

(A) Advantages of breakaway metal post systems:

- (1) Relative ease of installation (no need to dig a hole).
- (2) Possible reuse of the base post after vehicular impact, with resultant long-term cost savings.
- (3) Improvement in motorist safety provided by the breakaway feature.

- (B) Disadvantages of metal post systems are:
- (1) Posts are not interchangeable. Once a base post is placed, there is no economically feasible alternative except to purchase replacement posts of the same design.
  - (2) A variety of driving heads, bolts, and other materials must be carried in the sign truck to permit repairs or modifications to different installations.
  - (3) Underground utilities may be damaged when driving the post.
  - (4) Different methods of attaching signs to posts may require strengthening of some sign panels to prevent excessive bending and distortion of the sign message.
- (C) Special installations where the breakaway metal sign post system can be an acceptable alternative to wood posts, based on life-cycle cost, are:
- (1) Areas with a high incidence of hits.
  - (2) Locations where wood posts are vandalized.
  - (3) Where driving a post is easier than digging a post-hole (in granular, loose, or rocky soil).
  - (4) Where the post is required to blend with the surrounding environment.

Decisions to use steel sign supports for replacement purposes will be the responsibility of the district, and should be based on consideration of the above factors. Warehousing of all breakaway metal sign post systems is not anticipated at this time. Some orders may have to be placed through local distributors. Orders for a particular type of post must be justified.

## **M2.18 Timber Poles**

Installation of new or replacement timber poles (non-dimensional lumber) is no longer acceptable when sign supports with yielding or breakaway characteristics are required. Timber poles may continue to be used where the sign location is protected or where the sign is not readily accessible to traffic.

Protected locations include those behind guardrail, bridge railing, or similar barriers; or on cut slopes where the sign posts are located four (4) feet or more vertically above the edge of paved shoulder.

When timber poles are used behind barriers, the barriers must be required for purposes other than just to protect the sign. Drilling of holes and sawing of weakened plane breakaway joints will not be required at these locations.

Timber poles in existing locations may remain in place until damaged or otherwise directed to be removed by District Traffic Operations. Acceptable alternates for timber poles are the laminated box beam and breakaway steel supports for large signs. Combinations of timber poles and alternate sign supports will not be permitted in the same multi-post installation.

### **M2.19 Laminated Wood Posts**

Breakaway holes must be placed at the proper height above ground to prevent the remaining stub from snagging the bottom of an impacting vehicle. See current Standard Plan sheets for hole locations.

A laminated wood post (high-grade plywood in appearance) has been approved for installation of large signs in areas exposed to traffic, where timber poles were formerly the standard.

Laminated posts are designed to meet federal requirements for change in momentum during an impact by breaking cleanly when impacted by a lightweight vehicle traveling at 20 mph..

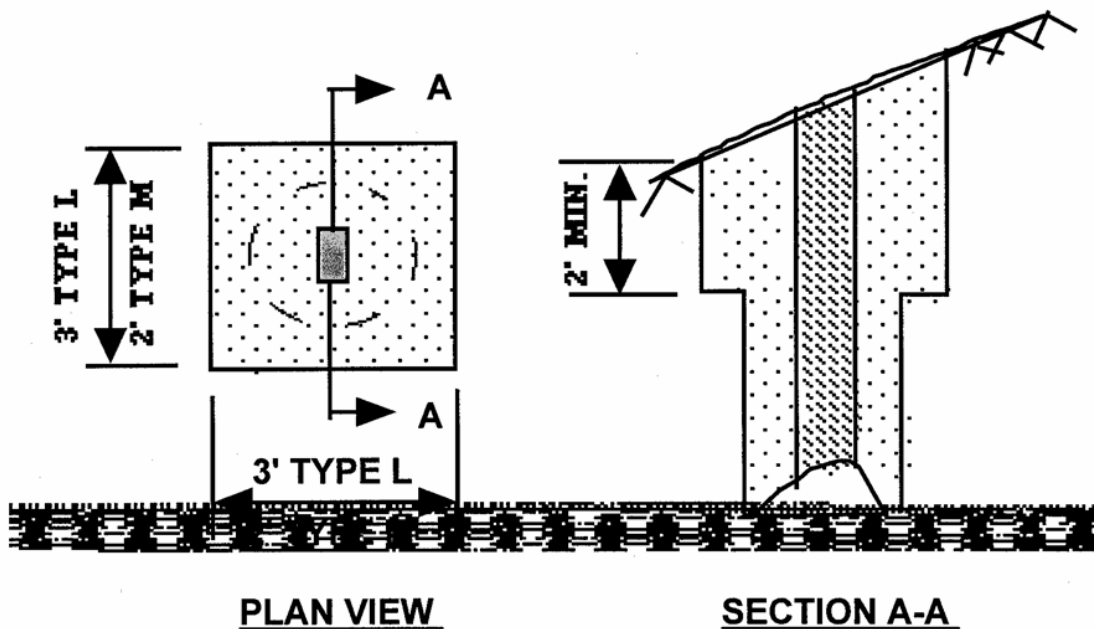
Laminated posts are relatively fragile and must be stored and handled carefully. Techniques for storing laminated box-beam sign posts require a minimum 6 inch clearance at the base of the pile, in addition to stickers placed between each layer of posts. Posts should be stacked on edge, and the top of the pile should be covered with a layer of plastic or tarp to prevent rain from damaging the posts.

Some of the newer laminated wood posts are coated with special waterproofing material to minimize cracking and warping and give a longer service life. Re-coating of these posts may be beneficial in the future if field inspections indicate that the coating film is breaking down.

To ensure that laminated wood sign posts will break away properly when hit and still not be damaged by high winds, it is important that posts be installed in holes as specified and back-filled with a granular material. The relationship of hole size and soil condition is critical in assuring that there is a proper breaking away of the upper portion of laminated wood box beam posts when hit. The bottom must be held firmly in place to allow a clean break of the post at ground level. Soft or yielding ground will permit movement of the entire post and the desired type of breaking will not be accomplished.

Two alternative post-hole configurations have been approved for use:

- (A) If the ground is very firm, similar to compacted highway fill, the hole diameter may be reduced six inches in diameter. For these conditions the permissive size of hole is 18 inches for the type "M" post and 24 inches for the type "L" post.
- (B) If the foundation material surrounding the post is not firm when in a saturated condition, the 18 inch and 24 inch diameter holes mentioned above may be used only if the upper portion of the hole is modified to provide satisfactory lateral support. This modification is to be accomplished by removing at least 2 ft. of the upper portion of the existing soil to the dimensions shown below, and replacing with a granular backfill material.



#### **M2.20 Breakaway Steel Posts for Use With Large Signs**

The wide flange breakaway steel sign post, which meets the federal requirements for change in momentum during vehicular impact, has been available for many years. Carefully follow plans that cover standard installations. Correct alignment of post sections and placement of bolts in the slip base is critical to proper functioning of the breakaway feature.

A major disadvantage of the steel breakaway post is the need to fabricate a new post every time an existing post is hit. This requires field measurement of the exact length required for replacement. Some time lag is inevitable before the steel post can be replaced.

### **M2.21 Overhead Steel Sign Supports**

Overhead steel sign supports are designed by the Division of Engineering Services. Repairs should be performed by contract unless the district has workers proficient in structural steelwork and painting.

### **M2.22 Hardware**

All signs shall be affixed to posts with galvanized hardware. Fiber or nylon washers shall be used to protect the face of the sign. Placing a metal washer between the fiber/nylon washer and the bolt head is recommended to provide more bearing and reduce rocking of the sign on the post. Use 5/16 inch x 7/8 inch washers for 1/4 inch bolts and 3/8 inch x 7/8 inch washers for 5/16 inch bolts. An additional washer placed between the nut and the post will prevent the nut from digging into the post during tightening.

The threads near the ends of bolts protruding from sign posts may be "upset" or deformed to prevent the nut from being removed by vandals. Districts may also purchase commercially available "anti-theft" hardware for use in areas subject to vandalism and theft.

Large signs placed on laminated box beam sign posts must be installed using 1/2 inch lag screws for attaching sign panels to the post. Lag screw pilot holes drilled in wood flanges for attaching sign panels must be 5/16 inches in diameter so that the panels will not blow down in heavy winds.

Bolting completely through the post is not acceptable practice because the sign panel will not readily release from the support post during impact.

Overlay plates for making changes to existing signs (not made from steel) shall be attached using aluminum rivets. Stainless steel rivets shall be used on the older porcelain on steel signs.

Galvanized back braces should be used for installation of all large single sheet signs placed on one post. A special back brace is available for one-post directional signs installed "off-center."

One-post installations of signs (with a height of 18 inches or more) require a small wood block between the center of the sign and the post to stiffen the sign and prevent "flutter" under some wind conditions. This block also causes the sign face to distort slightly, which reduces glare.

For details, see Standard Plan RS2. Do not use a block more than one (1) inch thick, as distortion will make the sign ineffective for night retroreflectivity.

### **M2.23 Supplemental information**

District Traffic Operations can provide current standards for each sign truck. Supervisors are responsible for assuring that the current drawings and standards are available for performance of work.

Upgrading (improving) existing installations to meet current standards is not normally funded from Maintenance allocations. Exceptions may occur where formerly used materials are no longer available, or where new materials can be expected to provide a longer service life, thereby reducing future maintenance costs.

These exceptions are normally justified at the Headquarters level, and instructions are transmitted to the districts for implementation.

Sign crews should retain copies of old Standard Plans and other reference documents for maintaining existing installations. The intent of this instruction is to eliminate "upgrading" of existing installations using funds dedicated for maintenance purposes in conformance with the law.

## **Section 3 – Safety Devices (Family Problems M6, M7, M8, & M9)**

### **M3.00 Introduction**

Safety devices are provided and maintained for the protection and guidance of traffic.

This section includes work in the following Family/Problem areas:

- M5 Roadside Delineator Post
- M6 Guardrail
- M7 Median Barrier
- M8 Vehicle Energy Attenuators (energy dissipaters)
- M9 Out of Control Vehicle Ramps (portion)

Unsatisfactory performance or problems with maintenance of traffic safety devices should be reported to the Division of Maintenance.

Refer to Maintenance Manual Volume 2, for planning, scheduling and administrative procedures connected with the “M” Family.

The following section (M3.01) discusses maintenance levels applicable to work in the “M” Family. Sections M3.02 and M3.03 describe the proper use and general guidelines for the various devices, and discuss installation and maintenance details and checklists.

### **M3.01 Levels of Maintenance**

The proper maintenance of traffic safety devices is important in providing maximum protection to the traveling public and for general appearance of the roadside. Levels of Maintenance, including frequency and priority of action for severe damage (any damage that can affect the ability of the safety device from performing its intended function) are included in Maintenance Manual Volume 2 for budgeting purposes. Levels may vary depending on overall appropriation of funds by the Legislature.

**M3.01.1      Guardrail**

Guardrail should be routinely observed for deficiencies. It should be maintained approximately true to line, grade, and functional height. Timely adjustments should be made to correct guardrail height when the original installation is degraded by the buildup of pavement or shoulder material, shoulder erosion, fill settlement, or any other cause. Missing anchor cables must be replaced. End treatments should be maintained according to the current Standard Plans.

Damaged rails and bent or missing delineators should be temporarily repaired if an obvious hazard exists or if functional integrity is impaired.

Permanent repair or replacement should be scheduled according to the priorities set in the Maintenance Manual Volume 2. Any remaining adjustments to line and grade should be done, when conditions permit, in conjunction with other repair work.

Rail that has previously been painted for delineation should be washed or repainted as needed.

Washing and painting of unpainted rail is not required. End caps on the downstream ends of guardrail adjacent to one way roadways should not be replaced when damaged.

**M3.01.2      Median Barriers**

For removable panels of glare screen that are missing, or damaged, contact the District Traffic Safety Device Coordinator for recommendation regarding if it should be maintained or replaced.

**(A)   Thrie and Metal Beam Barrier**

- (1)   Surveillance should be made for structural integrity, height, and alignment.
- (2)   Repairs should be made promptly if a traffic hazard exists or functional integrity is questionable. Damage not constituting a hazard to traffic or functional integrity should be repaired when the schedule permits.

**(B)   Cable Barrier**

- (1)   The effectiveness of cable barrier is extremely sensitive to the height of the cable.  
  
Make periodic surveillance for structural integrity, height, and alignment.
- (2)   When damaged, temporary repairs should be made promptly by propping up the cable to the height of the adjacent cable and cutting off posts that may be considered an obstacle to traffic.

- (3) Damaged posts should be scheduled for replacement at the earliest practical time.

Posts replaced in sleeves in the foundation may be back filled with concrete sand in lieu of paving asphalt.

- (4) Permanent repairs should be scheduled promptly. Surface irregularities such as berms, or windrows resulting from shoulder grading must not be allowed adjacent to cable barriers.
- (5) Reflectors on cable median barrier will not be maintained when the median edge is delineated by striping and/or raised pavement markers.
- (6) Questions concerning the maintenance of cable median barrier not covered here should be referred to the Division of Traffic Operations Liaison.

**(C) Concrete Barrier**

- (1) Concrete median barriers generally require little maintenance. Surveillance is necessary to ensure prompt repair when the barrier is broken or pre-cast units are toppled over or knocked out of line.
- (2) Concrete barriers are not to be painted to eliminate tire marks.
- (3) Retroreflective delineators, placed as part of the original installation or retrofitted to meet special needs, should be maintained with the reflectors clear of material that obscures them. Missing or damaged retroreflective delineators should be replaced promptly.

**M3.01.3 Crash Cushions**

Crash cushions, also known as impact energy attenuators, are intended to protect the motorist from the consequences of collision with a fixed object. Routine surveillance should be performed to ensure that these devices remain functional. Detailed inspections should be made to ensure that the components are in satisfactory condition.

Damage that impairs the functional integrity of attenuators should be repaired as soon as possible. Less critical damage may be repaired in conjunction with other maintenance operations.

Debris should be periodically removed from under or around attenuators. The accumulation of large amounts of debris can hinder sliding action and impair the functioning of these devices and presents an unsightly appearance.

**M3.01.4      Roadside Delineation Posts**

Roadside delineation posts should be maintained in an upright position, facing traffic and with reflectors clear of material that obscures them. Any markers or reflectors that are damaged or missing should be replaced to meet current standards. Post mile information (Rte-Co-P.M.) shall not be placed on markers that are not part of the post mile system. Flexible posts are the standard, however metal posts may be used as needed to accommodate driving posts in hard or rocky soil.

**M3.01.5      Damage Guidelines for Safety Barriers**

Severe damage as a result of an impact to a safety barrier (guardrail, median barrier, or crash cushion) is defined as any damage that significantly alters the structural integrity of a barrier and could alter the performance of a barrier during a subsequent impact. Examples of severe damage may be:

- Posts (for MBGR, Thrie Beam, or MBMB) are broken or out of alignment with original position by more than 12 inches horizontally.
- Metal sections (MBGR, MBMB, and Thrie) are out of alignment with original installation by more than 12 inches horizontally.
- Bolts are missing or have torn through metal sections.
- Metal sections have been split or torn.
- Sections of concrete have been loosened or knocked out of the barrier.
- Cable supports have been knocked down, or the cable is laying on the ground.
- Any end treatment or crash cushion damage.

There may be other examples of severe damage not listed here.

Damage that is not considered severe damage is damage that does not significantly degrade or alter the structural integrity of the barrier and is referred to as minor damage. Rubs and scrapes that do not push a metal barrier out of alignment more than 6 inches, and aesthetic damage such as tire marks are examples of minor damage.

**When a question arises on a specific location as to the extent of the damage and the impact on structural integrity, or the ability of the device to perform as intended, contact the District Traffic Safety Devices Coordinator in District Traffic Operations to have the location evaluated by an engineer.**

### **M3.02 Uses and General Guidelines**

#### **M3.02.1 Guardrail**

Guardrail is a safety barrier installed on State highways to reduce the combined effect of severity and frequency of "runoff the road" type crashes. This is accomplished by redirecting a vehicle away from embankment slopes or fixed objects and dissipating the energy of the errant vehicle. The W-beam channel is the most common barrier used for guardrail applications and is commonly known as metal beam guardrail (MBGR), though concrete and other types of barrier may be used. Guardrail sections also include the end treatments and transitions that are attached.

Existing guardrail is to be maintained in accordance with the Department of Transportation Standard Plans. Any deviation to install, delete, or modify must be by prior approval of District Traffic Operations.

The approach ends of most guardrail end treatments are usually turned away from approaching traffic to minimize the probability of an end on collision, depending on the end treatment used. Both ends of guardrail installations are anchored to prevent failure of short sections of guardrail and minimize "pocketing" during a collision.

End caps are no longer installed on the trailing end of guardrail adjacent to one way roadways and are not to be maintained. Existing curved end sections on the trailing end of one way roadway guardrail may be salvaged for use as needed.

Damaged breakaway terminals must be replaced with acceptable current standard breakaway terminals as approved by the Division of Traffic Operations.

Variable heights of guardrails are readily apparent to motorists, as well as being a potential safety problem and priority should be given to maintaining them to proper levels. Persons responsible for project reviews, construction and maintenance inspections should be alert to the potential need to adjust rail height because of pavement overlays.

Restoration of any damaged breakaway guardrail terminal is to be made by installing the current standard breakaway terminal as shown in the latest edition of the Standard Plans. Contact the District Traffic Safety Device Coordinators, Headquarters Division of Maintenance, or Headquarters Traffic Operations Liaisons for more information.

(A) The following guidelines should be used when replacing damaged guardrail:

- (1) Metal plate (Tuthill) guardrail is no longer appropriate for use on the State highway system. Damaged sections shall be replaced with standard guardrail.

- (2) In all cases when nonstandard guardrail is damaged to the extent that a section or sections must be replaced, District Maintenance will immediately advise District Traffic Operations, and corrective work will be initiated based upon their recommendations. Mixtures of old and new types of guardrail in a run should be avoided.
  - (3) When upgrading guardrail, current standards will apply as to post size and spacing, rail elements, anchorage and positioning. District Traffic Operations personnel will furnish Maintenance forces with the necessary guardrail design information.
- (B) Charges for replacement upgrading of damaged guardrail will be apportioned as follows:
- (1) The cost of "replacement in kind" of the damaged guardrail to be shown on the damage report should be an estimate based on the district's prior charges for similar work.
  - (2) Capital outlay costs (upgrading) will be the actual cost of replacement to current standards, less the amount for "replacement in kind" shown on the damage report.
  - (3) When any upgrading by Maintenance forces is involved in a replacement of damaged guardrail, a specific work order is required incorporating the split-funding provisions. Most districts have blanket type improvement Expenditure Authorizations (E.A.'s) to fund this type of work. When possible, upgrading of guardrail should be accomplished by contract.

#### **M3.02.2      Median Barriers**

Median barrier is a continuous safety barrier placed in medians of divided highways to prevent an errant vehicle from crossing the median and colliding with opposing traffic. Although not part of the initial design, it may also prevent the deflection of a vehicle colliding with the barrier back into traffic stream, and decelerate the errant vehicle within tolerable limits. Concrete Type 60 and metal Thrie beam are the most common types of median barriers. Cable systems and W-beam (looks like guardrail, but referred to as metal beam median barrier MBMB) have also been used in median barriers.

See California Standard Plans for flares and special conditions covering median barrier installations.

**(A) Thrie Beam Barrier**

Thrie beam barrier is a type of metal beam barrier that has rail elements containing 3 ribs that are 20 inches high. There is no channel rail. The top of the rail is 32 inches above the ground.

**(B) Metal Beam Barrier**

The top of metal beam median barrier is 30 inches above the ground beneath the rail.

The top of the posts are level with the top of the rail element. The blocks extend approximately 1 inch above the top of the posts and rail elements.

**(C) Cable Barrier**

Emergency openings in cable barrier must be secured after use. Failure to do so reduces the effectiveness of a substantial length of cable barrier.

Research indicates that consolidated sand is a satisfactory filler material in lieu of asphalt for use in cable barrier post footing sockets. As a result, dry, clean, commercial quality concrete sand may be used as an alternative filler material in "Type B" cable barrier footings. The sand should be consolidated and compacted in the post socket by a minimum of 25 hammer blows to each side of the post.

Questions concerning the maintenance of cable barrier should be referred to the Division of Traffic Operations Liaison.

**(D) Concrete Barrier**

The top of Type 50, concrete median barrier is 32 inches above finished grade. Present design of the barrier does not call for a below ground footing except at ends or joints in the barrier. The Standard Plans indicate the location and amount of steel reinforcement in the barrier. The Type 60 single slope concrete median barrier, is the current standard and is being installed throughout the State.

The standard height for the Type 60 barrier is 36 inches, although 32 inch and 56-inch tall barriers may be installed as field conditions dictate. Check the latest Standard Plans for complete details and clarification.

**M3.02.3      Crash Cushions**

Crash cushions, also known as impact energy attenuators, are intended to reduce the severity of a collision with a fixed object that cannot be removed or protected by other types of protective systems.

Cushions/attenuators are expensive to install and maintain. Special problems or unsatisfactory performance should be immediately brought to the attention of District Traffic Operations.

Type R chevron markers should be installed on the front of the attenuators whenever traffic may proceed on either side of the installation. The point of the chevron should be at the top of the marker.

**(A)   Collapsible Units**

Present designs of water filled plastic tube, and lightweight crushable canister attenuators use overlapping fender panels along the sides of the assembly. These systems are held in position by anchor cables and use a backup structure.

Successful operation of sliding type units depends to a large extent on keeping the area free from objects and debris that can resist movement of the units. Care must be taken in machine sweeping to assure that there is no excessive buildup of debris within the device.

**(B)   Sand Filled Units**

Sand filled plastic barrels are free standing and approximately 3 ft. in diameter by 3 ft. These barrels contain specific weights of sand depending upon their location in the installation. Sand filled barrels may "walk" or move downhill when installed on a slope. When this occurs, a stop or restraint is needed for each barrel.

Location of the barrel in the array and weight of sand in the barrel are critical in determining how the unit functions when impacted.

Whenever possible, location and weight of the barrels should be painted on the pavement to facilitate replacement. If this is not possible (e.g., installations in unpaved areas), weights can be marked on a marker Post Plate.

Copies of "As Built" plans can also be used to supply the information. Marking the weight on the sides of barrels or on the lids is unsatisfactory since these notations are lost in most impacts. Contact District Traffic Operations when no other information is available.

Sand used in filling barrels must be capable of remaining in a loose condition throughout the expected life of the barrel. Sand that contains clay particles, or is not well graded, is capable of exerting excessive stresses during expansion/contraction of the barrels, and can cause premature failure of the unit. Cohesive materials can also result in failure of the array to dissipate energy when impacted by a vehicle.

Until further modified by the Engineering Service Center, Office of Materials Engineering and Testing Service, the following recommendations should be followed in filling barrels :

1. The sand used to fill modules shall be a clean washed concrete sand of commercial quality conforming to the sieve analysis requirements of ASTM C33- with no more than 1 percent of the sand passing the No.200 sieve. The sand must not contain clay lumps.
2. Bagged sand shall not be used. At the time of placing in the modules, the sand shall not contain more than 7 percent water, as determined by Test Method No. Calif. 226.
3. Laboratory tests have shown that sand filled crash cushions will function correctly when "Energite", "TraFFix" and "Fitch" sand barrels are mixed, as long as the array position and sand weight are maintained.
4. Lids should be fastened to the sand barrel shell consistent with the manufacturer recommendations. This is to minimize the scattering of debris during an impact. Some sand barrel lids have traveled a considerable distance. The placement of 4 pop-rivets, spaced equal distance, around the barrel are satisfactory.

#### M3.02.4      Roadside Markers

Roadside markers comprise the various permanent devices, excluding signs, used off the traveled way to guide the motorist and warn of restricted width and/or identify or mark locations along the highway. Instructions for use of roadside delineators, object markers, and channelizers are included in Part 3 of the MUTCD and the CA Supplement.

- (A) Flexible delineators will generally be used for maintenance replacements unless the following conditions are met:

- (1) Where it is necessary to attach snow poles to posts.

- (2) In rocky areas or hard ground where steel posts have some advantage in driving.

Consideration may be given to the possibility for using a two part, metal base and flexible post system in these areas.

- (3) In protected areas where posts are not exposed to traffic (such as behind guardrails and in front of structures).
- (4) When there is a need to support post mile markers.

Decisions regarding locations on existing roads which warrant the use of flexible delineator posts shall be the responsibility of District Maintenance in consultation with District Traffic Operations. Circumstances of weather, snow removal, difficulty of installation or other special needs will dictate when metal markers are required.

Any widespread district program to upgrade undamaged installations to provide uniformity of appearance is considered "improvement work" and cannot be done using Maintenance funds.

Replacement and salvage of guide markers in good condition is not generally cost effective. An exception may be considered where, after knocked down markers have been replaced, the remaining metal guide markers in good condition on a particular ramp or curve represent 25 percent or less of the total number of delineator posts. In this case, replacement of the remaining metal markers for the sake of uniform delineation treatment may be considered.

Excess markers are a needless expense to install and maintain and should be avoided whenever possible. However, except for culvert markers and clean out markers used by Maintenance, all markers on the system should be maintained unless directed otherwise by the District Traffic Operations.

**(B) Delineators**

Attention is directed to Standard Plan A73C and Figures 3D-101 through 3D-105 of the CA Supplement. The purpose of delineators is to indicate the roadway alignment and to accent critical locations. Delineators should not be used for other purposes. The practice of using them to mark drainage structures, pull boxes, underground utilities, etc. should be discontinued.

All delineators shall be retroreflectorized. Retroreflective sheeting shall have a minimum dimension of 3 inches in width and 12 inches in height.

Uniformity of type, color, and positioning of reflectors to delineate the roadway is essential. All proposed deviations from the patterns shown in the MUTCD and the CA Supplement should be cleared by District Traffic Operations.

The overall line of delineators should parallel the roadway centerline as closely as possible. When possible, delineators should be placed 2- ft. outside the edge of the usable shoulder but not more than 12-ft. from the pavement edge. In curbed sections, the markers will be placed 2- ft. outside the face of the curb.

**(C) Clearance Markers**

Attention is directed to Standard Plan A73B and Figure 3C-101 of the CA Supplement. Clearance markers are used to indicate obstructions or restrictions in width to the right of traffic, including bridge and culvert rails. They should be placed for all major obstructions in the plane of the roadway and within 4-ft. of the edge of shoulder. On divided highways, clearance markers are also used to the left of traffic for the same purpose. All clearance markers are retroreflectorized for night visibility.

Clearance marker posts are placed on a line with the edge of the obstruction nearest to the pavement. When placed in conjunction with guardrail on bridge approaches, the clearance markers are located immediately behind the guardrail and at sufficient height to make all reflectors visible to approaching traffic.

**(D) Culvert Markers**

Attention is directed to Chapter 3D of the CA Supplement in section entitled “Culvert Markers.” Culvert markers are placed as a convenience to Maintenance crews in marking locations of culvert openings. Such marking is sometimes necessary to protect culvert ends from damage from adjacent operations as well as to serve as an aid in locating culverts during storm conditions.

Most culverts can be located without the use of markers and in such cases, and if protection is not needed, markers need not be used. When culverts are difficult to locate, markers may be placed on each side of the roadbed, above the culvert. They may be placed either outside or in line with a series of markers.

Culvert markers should not be retroreflectorized except where the marker is well off the traveled way and locating the culvert could be a problem during hours of darkness. The possibility that the culvert marker might be mistaken for a road delineator should be avoided.

Culvert markers are not part of the post mile system for identifying locations and post mile markings (Rte.-Co.-P.M.) are not to be stenciled on replacement culvert markers.

If needed for Maintenance identification of a particular culvert, crews should stencil only the numerical value of the post mile (not route and county) on new or replacement markers.

Removal of excess culvert markers may be done at any time as part of routine Maintenance operations. Revision of existing markers to eliminate retroreflectorization and post mile markings, should be performed whenever the marker requires replacement for other purposes.

**(E) Emergency Crossover Markers**

Attention is directed to Chapter 3D of the CA Supplement in section entitled “Emergency Passageway Marker.” Markings for abandoned or obliterated crossovers should be removed.

Use of fencing and or gates at crossover locations to prevent unauthorized use is strongly discouraged, except in the most unusual circumstances. Acceptable locations for the establishment of gated crossovers would be for use for incident management detours or snow removal operations.

**(F) Post Mile Markers**

Attention is directed to Standard Plan A73B for Highway Post Marker. The post mile marker is an integral part of the post mile system, and is used by traffic officers, Maintenance personnel, and others to locate specific incidents or features on the roadway with respect to the post mile system. Post mile markers should not be used for additional marker functions, and other type markers should not be used as post mile markers. The post mile marker shall indicate the route, county, and post mile of the installation; only post mile markers shall contain the route and county designation.

The lettering size shall be 2½ inch letters for county, route and post mile fraction (hundredths). The post mile numerals shall be 4-inches in height.

Post mile markers shall not be retroreflectorized. When installed behind guardrail, the marker should be placed so that the entire legend is readable from the road.

Stenciling of the post mile on concrete median barriers is permissible in addition to, but not in place of, the regular post mile markers located along the outer shoulder. This is an additional aid for Maintenance and accident investigation forces.

District Traffic Operations shall have the responsibility to verify the accuracy of the placement of post mile markers. All post mile markers should be located to an accuracy of 50 ft. (0.01 mile) on the ground. The value shown on the marker shall be to the nearest 0.01 of a mile, and shall reflect the mile point of the centerline opposite the marker location. If any are found to be more than +/- 0.01 mile from the intended location, they must be relocated.

Periodic field review and inspection should be conducted to locate damaged or illegible markers. Reports of incorrect post mile markers may originate from various sources.

The District Traffic Operations and the Roadway Records unit of Headquarters Division of Traffic Operations must be in agreement as to which field markers will be corrected and which accident records will be relocated before any action is initiated. Care must be taken in replacing damaged markers to assure that the new marker is installed in the same place as the old marker.

**(G) Miscellaneous Markers**

Roadside markers are sometimes used to mark the location of pull boxes, survey monuments, water line crossings, etc. Where such items are readily visible or can be found easily, marker posts should not be installed. These markers shall not be retroreflectorized. When placed adjacent to the shoulder, the markers should face approaching traffic.

**M3.03 Installation/Maintenance Details and Checklists**

Installation standards and drawings for traffic safety devices may change as new materials, equipment, and traffic needs are identified. Be sure that the latest information is used for any new installation.

District Traffic Operations will provide current standards for each installation. Supervisors are responsible to assure that current drawings and standards are available for performance of work.

**M3.03.1 Metal Beam Guardrail, Thrie and Metal Beam Median Barriers**

- (A) Check the plans. Know what the design requires.
- (B) The 6-inch side of 6-inch x 8-inch timber posts should be next to the rail.

- (C) The posts should be set to the full depth shown on the plans. If this is not possible due to the presence of spread footings or other underground obstruction, some acceptable alternative method of setting the posts securely should be used. The Standard Plans contain some alternatives. Others may be obtained through the Construction Division or District Traffic Operations.

- (D) All rail laps should be in the direction of traffic adjacent to the rail.

- (E) Splice bolts should be tight with full bearing on the rail and not on bolt shoulders. The recess in the nut should face the bolt shoulder. Otherwise, the splice will not be tight.

Use all the splice bolts the plans call for.

- (F) Bolts should be long enough, so that nuts, are threaded completely onto the bolt. A one (1) or two (2) thread connection is not satisfactory. This should be checked, especially at connections to structures.

- (G) Excessive bolt "stick through", exposed threads beyond the nut, more than ½ inch should be cut off. This is especially important where there is pedestrian or bicycle traffic behind the barrier. Excessive bolt length on beam barrier can increase sheet metal damage in otherwise minor collisions by vehicles. Threaded ends of bolts shall not be placed on the traffic side of the rail.

- (H) Rail elements should be at the proper height for the type of barrier being installed.

Where the rail element is too low, less than 27 inches for guardrail, there is an increased chance that a vehicle may go over the top of the guardrail. Where a guardrail element is too high, more than 28 inches, there is an increased chance of a small vehicle snagging on a post below the rail.

- (I) The area in front of barriers should be flat and smooth, free of berms, dikes, curbs, windrows, watering basins, and ruts.

- (J) Anchor cables should be taut with no obvious slack in the cable. This will ensure that tension is quickly developed in the rail element during a collision and minimize any tendency towards pocketing of the vehicle.

- (K) Concrete anchors and footings should be built according to dimension shown in the plans. Undersized footings, where soil has caved into the hole before concrete was placed, have been torn out of the ground by impacting vehicles.

- (L) Roadside rails may have longer posts or other design modifications when installed where the ground is loose or where there are steep side slopes. These modifications are made to provide additional lateral support to the posts. Be alert in recognizing these installations so they can be maintained as constructed.
- (M) Where cable clips are used, the saddle of the clip should be on the live or load carrying end of the cable. If not, the cable can slip, the rail will not develop full tension and a vehicle can penetrate the guardrail.
- (N) Avoid, if possible, making "off the cuff" field changes in planned installations. Small changes in an installation can result in greatly different performance during a collision.
- (O) Where there is a problem, or if something is not clear, ask questions. If you observe something that does not work the way it should, either in building it, maintaining it, or in expected performance, seek help through your district or Headquarters office.
- (P) Guardrail and barriers do not prevent accidents; they lessen the severity of collision when installed at justified locations.

**M3.03.2      Sand Filled Impact Energy Attenuators (Crash Cushions)**

- (A) Check the plans. Know what the installation requires.
- (B) Read manufacturer's installation instructions. Changes can occur. There are differences in manufacturer's designs.
- (C) Don't install barrels on soft ground or AC that is not compacted. The barrels will sink in unevenly, distorting the barrel and eventually leading to failure.
- (D) Open bottom (Fitch) barrels should not be installed on bare ground. Rodents can burrow underneath and into the barrel. An AC pad may prevent this. Also, water can more readily soften the ground under such barrels leading to its eventual failure.
- (E) Barrels should not hang over curbs on raised gore surfaces.
- (F) Weight of sand should be painted on pavement under or beside the barrel. This makes repairs easier.
- (G) Maintenance crews responsible for maintaining sand filled cushions should get a set of plans or drawings for each project showing the sand barrel pattern and sand weights in each barrel. This is especially important where sand weights have not or cannot be painted on the ground.

- (H) Lids should be pop-riveted to shells on Fitch barrels to minimize the lids flying about during an impact. The new lids are heavier, weighing 8 pounds to 10 pounds. If it is necessary to secure “Energite” or “Trafix” lids on barrels, they should be pop-riveted.
- (I) Energite Inner Cones and Fitch Sand Support Structures should be installed in accordance with the manufacture's instructions to ensure proper performance. Sand should be added to the levels indicated on the sides of the barrels.
- (J) Be sure that the sand meets specifications. Cleanliness is most important. Dirty sand can cake and result in split barrels. Very fine sand may slowly leak out. Do not use sand in bags. Use only loose sand.
- (K) Check the amount of sand in all barrels. Weights should conform to those shown on the plans.
- (L) Barrels with cracks through the walls that are permitting sand to leak out should be replaced as soon as possible. This assures the proper performance of the crash cushion.
- (M) If something is not understood or if you have questions, be sure to ask. Contact the Division of Maintenance or Division of Traffic Operations for questions.
- (N) All approved sand barrels (Energite, Fitch, Traffix) may be mixed in an approved array, as long as the barrel has the proper sand weight for its array location. Note: the current Standard Plans have the approved arrays shown.

#### **M3.04 Out of Control Vehicle Ramps**

Arrestor bed escape ramps require smoothing after every entry. An aggregate bed that contains humps and hollows can be very difficult to traverse and may unnecessarily damage the truck. Thus, it is essential that the aggregate bed be reshaped as soon as possible after a vehicle has been removed from the gravel.

Gravel tends to pack with time or repeated traversals by equipment. Thus, the gravel should be loosened up or scarified after each ten uses of the ramp or every six (6) months (Spring and Fall), whichever occurs more frequently. Whenever the gravel is scarified, it should be examined for contamination. Then, if an excessive amount of fine material or other contaminants is noted, immediate provisions should be made to replace or reprocess the aggregate to original specifications. Another indicator that the aggregate is becoming contaminated is when vehicles using the ramp travel increasing distances along the ramp. Use of the proper grade of stone cannot be over emphasized due to the potential liability.

Maintenance of an arrestor bed escape ramp requires adequate equipment. Hand tools are not acceptable. Proper power equipment assures that the ramp will be back in service in a minimum amount of time. It also ensures that Maintenance workers will be minimally exposed to the chance of a runaway truck wanting to use the ramp.

Equipment considerations may include a motor grader with an extension on its blade so the final pass in smoothing the gravel may be made from the service road. Another possibility is using a snow cat or some other light footprint vehicle. Since escape ramps are located in mountainous terrain and their use is more frequent in warm weather, the availability of snow cats is a possibility.

# CHAPTER R

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Appendix R-1 Chain Requirements

Appendix R-2a Chain on (2-lane)

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Original signed by

Nate Cradle

Office of Maintenance Equipment and Training

Division of Maintenance

**R.00 Introduction**

(A) The snow removal and ice control family (HM6R), includes all work in connection with the following:

- (1) Snow removal operations.
- (2) Drift prevention.
- (3) Installation and maintenance of snow fences.
- (4) Snow pole installation and removal.
- (5) Tire chain fabrication and repair.
- (6) Maintenance and control of chain control locations.
- (7) Avalanche control.

The program also includes truck haul of snow to waste areas, opening drains covered by snow and ice and the spring opening of roads that are normally allowed to close for the winter season. Mechanical and manual sanding and the use of deicing agents, both solid and liquid solution types are also included.

Refer to Maintenance Manual Volume 2 for administrative procedures to be used in connection with this work.

(B) Terminology:

- (1) Deicer

Deicer is a chemical freezing point depressant such as, but not limited to, salt (sodium chloride), salt brine, CMA (calcium magnesium acetate), liquid potassium acetate, or liquid magnesium chloride. Deicers are used to melt already formed frost, snow, or ice.

- (2) Anti-icer

Anti-icer is a chemical freezing point depressant (as defined above) used to prevent the formation of frost, snow, or ice on a road surface.

(3) Pack

Pack refers to a buildup of ice and/or compacted snow on the road surface.

(4) Bare Pavement

Bare pavement means the road is clear of loose snow but may have patches of ice or snow pack that, when treated with chemicals or abrasives or a combination of these, may be negotiated safely by the average driver without the need of chains.

(5) RWIS (Road Weather Information System)

The RWIS is an installation of weather and pavement sensors that is used to monitor conditions at a remote location. Some RWIS can use historical data previously gathered to predict local weather as a decision making tool for Maintenance and Construction operations.

(6) Chain Requirements

Chain requirement means chains or traction devices will be required when, in the judgment of the Maintenance Supervisor on duty, snow and ice conditions make it difficult for the average driver to control their vehicle. Chains or traction devices are defined in the California Vehicle Code Section 605, generally called “chains”, and are used to increase the traction of vehicle tires on snow or ice covered pavements.

(7) ATDs (Automatic Traction Devices)

ATDs, or automatic traction devices as defined in the California Vehicle Code Section 605, are devices that can be automatically deployed by the driver of a vehicle. These devices are most commonly found on trucks and buses.

## **R.01 Policy**

In compliance with Section 95.6 of the California Streets and Highways Code, Caltrans adopted the following policy in July, 1992:

“Snow removal and ice control shall be performed as necessary in order to facilitate the movement and safety of public traffic, and shall be done in accordance with the best management practices outlined herein with particular emphasis given to environmentally sensitive areas.”

This policy is outlined in the Caltrans report to the Legislature in response to Chapter 318, Statutes of 1991 (Hauser), “The Use of Deicing Chemicals on California State Highways” July, 1992.

- (A) Through coordination with the Chief, Division of Maintenance, each district is responsible for preparation of detailed operational guidelines for their individual snow routes. These will be based on overall needs.

Factors to be used in determining these needs are:

- (1) Average daily traffic (ADT).
- (2) Congestion and traffic delay.
- (3) Safety.
- (4) Availability of alternate routes.
- (5) Consequences of not providing appropriate level of service.
- (6) Public interest and concern.
- (7) Potential economic impact.
- (8) Environmental considerations.

Final determination in levels of service will consider cost and budgetary constraints.

- (B) In addition, districts are to comply with the following requirements regarding their snow and ice control programs:
- (1) Maintain accurate records of the locations and quantities where salt and other deicers are used.
  - (2) Provide necessary training for Maintenance personnel involved in snow and ice control efforts.
  - (3) Calibrate equipment used to apply deicing and anti-icing chemicals or abrasives.
  - (4) Identify areas that are potentially environmentally sensitive. This includes vegetation areas and bodies of water receiving direct roadway runoff.
  - (5) Submit to the Chief, Division of Maintenance, no later than October 15<sup>th</sup> of each year, an annual Snow Plan for the next winter season, including proposed levels of service, chemical usage, and any proposed changes to operations in environmentally sensitive areas. Only changes or revisions to each Snow Plan need to be submitted in subsequent years. If no changes or revisions are made, a statement should be submitted to verify that no changes have been made, and that the current Snow Plan is still in effect.
  - (6) At the close of each winter season, no later than August 1<sup>st</sup>, each district is to submit to the Chief, Division of Maintenance, a complete report specifying the quality of salt and other deicers used.

This report, commonly referred to as the “Salt Report”, will also include a recapitulation of the salt inventory at the beginning of the season, the quantity of salt received during the season and the inventory of salt on hand at the end of the season. The same usage information is required for all other deicers and anti-icers used.

## **R.02 Maintenance Levels**

Snow removal and ice control are necessary to provide as safe a travel way as possible and will balance traffic demands, amount of traveler delay, and environmental impacts. It is expected that R-1 and R-2 chain controls will need to be used on some routes. All roadway segments subject to snow and ice conditions will be designated with a Snow Road Classification “A”, “B”, “C”, “D”, or “E”. The level of service to be provided will be dependent on this classification of each segment. The determined level of service for each route will be determined by each district with concurrence of the Chief, Division of Maintenance. Any changes to the current designated level of service must be approved by the District Director or his or her designee, and will be immediately reported to the Chief, Division of Maintenance.

Snow Road Classifications are defined as follows:

(A) Snow Road Classification “A”

Snow will be removed continuously during a storm to keep the road open for traffic except when poor visibility or avalanche hazard exists. Chain requirements will be lifted and the roadway returned to bare pavement as soon as possible. Patrols will be established for those areas where conditions require surveillance of the roadway for possible snow, ice or avalanche hazards. Anti-icers, deicers, or abrasives, or a combination of materials should be applied to enhance traffic safety as deemed necessary by the supervisor on duty.

(B) Snow Road Classification “B”

This level is the same as “A” above, except that, chain requirements will be lifted and bare pavement achieved within 48 hours after the end of the storm.

(C) Snow Road Classification “C”

At this level, only enough snow should be removed during the storm to keep the road open and safe for traffic. Around the clock shifts may be necessary to accomplish this.

Patrols will be established for those areas where conditions require surveillance of the roadway for possible snow, ice or avalanche hazards. Anti-icers, deicers, or abrasives, or a combination of materials should be applied to enhance traffic safety as deemed necessary by the supervisor on duty.

(D) Snow Road Classification “D”

Snow should be removed only during normal daytime work shifts, except that some routes may be plowed at any time when the District Director determines there is sufficient reason for plowing. Some routes may be allowed to close temporarily during moderate to heavy storms when the District Director determines this to be the appropriate course of action. Once open, anti-icers, deicers, or abrasives, or a combination of both should be applied to enhance traffic safety as deemed necessary by the supervisor on duty.

(E) Snow Route Classification “E”

These routes are allowed to close during the winter, and are reopened in the Spring when it is reasonable to assume the storm possibilities are over.

**R.03     Organization and Practice**

Deputy District Directors, Maintenance, Maintenance Region Managers, and Area Superintendents shall make advance preparations so that snow removal work can begin with the first storm. Weather forecasts and temperature readings must be monitored frequently during the winter season.

RWIS should be utilized if available. Regularly assigned crews should be supplemented by transfers from non-snow areas, personnel from other agencies by interagency agreement, permanent intermittent, limited term, and temporary help personnel as available.

Close cooperation, good communications and application of the principles of teamwork with members of the California Highway Patrol (CHP), local law-enforcement, and other governing agencies are essential for successful snow removal operations.

Roads having extremely light winter traffic (snow route classification “E”), where the expense of snow removal is not justified, are closed after the first significant snow.

With the exception of Sno-Parks, established State maintained parking areas, and under properly executed Maintenance Agreements negotiated with other agencies, State forces shall not remove snow beyond the right of way line. Property owners may clear snow from driveways within the right of way and deposit that snow only on the portion of the right of way not used by vehicles or pedestrians. No snow from other portions of private property shall be deposited on the right of way.

In business districts where snow cannot be blown out and there is sufficient roadway width, snow may be plowed to the center of the road for later removal. Where openings are made in center of the road snow berms for left turns and cross traffic, the openings should be made wide enough to provide a reasonable sight distance. When temperatures warm sufficiently for melting, center of the road snow berms may be spread as a thin layer on the traveled way as a method of snow removal in lieu of expensive snow hauling. This method may only be used in areas where it is a practice acceptable to local environmental authorities.

At resorts and clubs where parking may be continuous over storm periods or for overnight or weekends, space for parking should be provided by the resorts or clubs beyond the right of way.

If cars are parked within the right of way, it is the responsibility of the resort or club officials to have such cars moved, if snow removal equipment is expected to clear the area. If private vehicles are parked on the traveled way, the CHP should be requested to remove the vehicles.

A preferred method of controlling pack is mechanical removal. Sufficient deicer chemicals may be applied at the beginning of a storm to deter bonding and minimize the buildup of pack. When pack does build up, chain controls can be utilized as appropriate to provide safe travel conditions until the surface has been treated with abrasives or bare pavement conditions are achieved.

When possible freezing conditions are anticipated, special patrols should be scheduled for the detection and correction of slippery conditions. Particular attention should be paid to curves, intersections, grades and problem locations such as shaded areas and bridges. Anti-icing liquid deicers can be applied, sometimes many hours in advance of anticipated freezing conditions, to prevent frost and ice from forming and reducing the need for some after-hours patrols.

(A) Areas of Special Consideration

(1) Bridge Decks

Salt applied to bridge decks can cause corrosion damage to structures and should be used with caution. Non-chloride chemical deicers are recommended whenever possible. At lower elevations, slippery conditions on bridge decks can often be mitigated by use of properly constructed chip seals (Contact Bridge Maintenance Engineer). Application of abrasives and non-chloride deicers can be used to control frost.

(2) At Grade Railroad Crossings

When removing snow at railroad crossings, every precaution should be taken to ensure that ice, snow, abrasives and other debris is not deposited and left on the crossing. When engaged in plowing activity at railroad crossings, plow trucks must come to a complete stop, adjust the plow to clear all obstructions and carefully cross the tracks before resuming regular plowing. This procedure will prevent damage to the tracks and plowing equipment.

(3) Snow Fence and Jet Roofs

Inspect annually and repair, preferably two (2) or three (3) months prior to anticipated snowfall.

(B) Snow Pole Policy

Snow poles used for delineating the highway should be replaced if damaged, or reinstalled where removed, before the first snowfall. These should be placed at the shoulder edge in accordance with policy.

Snow poles are an essential element in almost all snow removal operations. The basic purpose of a snow pole is for guidance for snow removal crews and the public during and after storms.

Snow poles are placed to accomplish the following:

- (1) Delineate culvert ends.
- (2) Delineate slope drains.
- (3) Mark beginning and end of dikes.
- (4) Mark beginning and end of guardrails.
- (5) Delineate bridge rails.
- (6) Delineate ramp gores.
- (7) Delineate median islands.
- (8) Delineate at-grade railroad crossings, and metal cattle guards.
- (9) Delineate miscellaneous obstructions to plows such as rock outcroppings.
- (10) Delineate objects that could be damaged by snow from rotary snowplows (cabins, homes, trailers, advertising signs, etc.).

(C) Color Coding of Snow Poles

The intent of this policy is to standardize the color coding of snow poles that is consistent throughout the State and to provide guidance for snow removal crews in identifying the above listed obstructions and objects within or near the right of way.

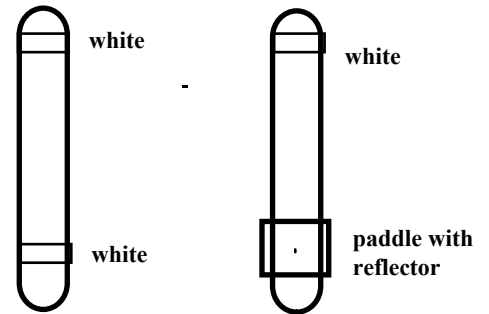
(1) Color Coding

All snow poles shall be color coded with one or more bands of 3 inch wide high intensity type "Encapsulated lens" reflective sheeting (tape) wrapped around the pole with a minimum 1-inch overlap or painted with an approved reflective type paint.

References to placement of tape on poles are to top of tape. Types of snow pole installations and their color coding are as follows: (Note: All references to "4 feet from ground" apply to freestanding poles only. Delineators with extensions are not subject to tape at the 4-foot).

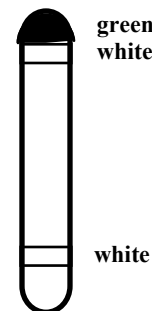
(a) Standard Snow Pole Installation  
(freestanding pole or guide marker and extension).

White tape 3 inches from top of pole and 4 feet from ground.



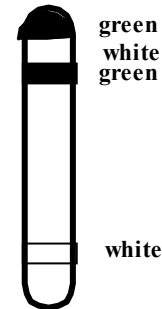
(b) Culvert Marker

Green tape at top of pole, white tape 3 inches from top and 4 feet from ground.



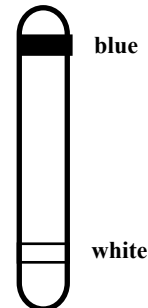
(c) Slope Drain

Green tape at top of pole, white tape 3 inches from top, green tape 6 inches from top, and white tape 4 feet from ground.



(d) Roadside Obstructions (bridges, guardrail, curbs, dikes, etc.).

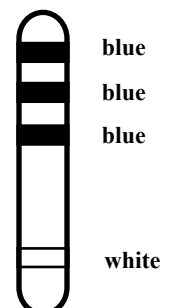
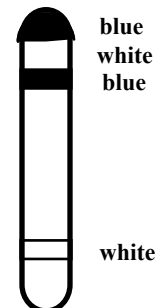
Pole at beginning of obstruction and continuing through obstruction, blue tape 3 inches from top of pole, and white tape 4 feet from ground.



End pole, white tape 3 inches from top of pole and 4 feet from ground (same as "a").

(e) Highway Obstructions Requiring Plow to Stop (metal cattle guards, at-grade railroad crossings, etc.).

Pole 300 feet ahead of obstruction, blue tape at top of pole, white tape 3 inches from top, blue tape 6 inches from top, and white tape 4 feet from ground.

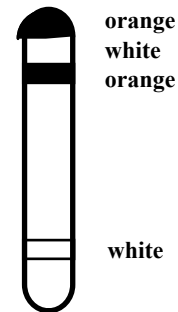


Pole at obstruction, blue tape 3 inches, 9 inches, and 15 inches from top of pole, and white tape 4 feet from ground.

- (f) Rotary Snowplow Obstructions  
(cabins, homes advertising signs, high voltage lines, transformers, frontage roads, ski trails, etc.).

Pole at beginning of obstruction and continuing through obstruction, orange tape at top of pole, white tape 3 inches from top, orange tape 6 inches from top, and white tape 4 feet from ground.

End pole, white tape 3 inches from top of pole and 4 feet from ground (same as “a”).



In order to minimize the danger to the neon type of advertising signs during snow removal operations, it is suggested that the protection of these signs be discussed with the owners prior to the start of the snow season. In some cases, wire screens have been installed by the owners to provide protection against the discharge of snow from the right of way. It is often helpful to have the sign lights left on all night during the winter season to assist equipment operators in recognizing the unit. Where heavy snow removal requires use of rotary plows, the operators should be instructed to reduce speed in the areas where adjacent buildings or facilities might be damaged by the flying snow, and to direct the chutes to minimize this danger. Operators are to respect private property at all times.

Care must be taken to avoid damaging cars parked adjacent to the highway.

(2) Type of Pole

Fiberglass slip in or add on type snow poles shall be used on guide markers.

Length may vary as required. (For detail regarding use of delineators, refer to Section 6 of the Traffic Manual). These poles shall be black with an ultraviolet inhibitor to prevent them from bleaching to white or yellow.

Hat shaped or 1 inch black pipe, free standing type snow poles may be utilized in heavy snowfall, high altitude areas, or areas subject to extreme vandalism or theft.

Duplication of poles in an immediate area should be avoided; i.e., where one pole can perform several desired functions in lieu of more than one.

Maximum use of delineators supplemented with snow poles should remain the preferred method to reduce numbers of poles needed and to better perform roadside delineation.

(3) Placement of Snow Poles

The minimum number of poles necessary shall be utilized.

A 400 feet or more spacing between poles should be the goal, recognizing exceptions for areas of poor alignment, fog, and severe blowing and driving snow conditions.

In areas with low annual snowfall, it may be appropriate to delete snow poles and rely on existing guide markers only. Snow poles shall not be removed during the summer months unless there are compelling reasons to do so.

#### **R.04 Equipment**

In territories of light snowfall and lower levels of service, light dump trucks equipped with light push plows are recommended. Where the snowfall is heavy and the levels of service are higher, motor graders, heavy trucks 8 cubic yards and bigger with heavy (Type C) plows, rotary snow plows and heavy plow trucks equipped with exhaust heated slip in sander bins should be used.

On major routes, the main plow unit should be the 8 cubic yards and bigger sander truck (3-axle) equipped with Type C plows and wing plows. This increases production and cuts down on the amount of equipment needed. It is recognized that if pack is allowed to build up, the motor grader and heavy use of deicing chemicals may be necessary. Under-body mounted truck plows are faster than motor graders at cutting pack off and should be used if available. Reversible plows are utilized where it is necessary to push snow either to the right or the left.

Rotary plows are used to clean up deep berms of snow left on the shoulders and to open mountain pass roads that are allowed to close in the winter. Occasionally, drifts and avalanches are deep enough that rotary plows are required. Large truck plows equipped with a wing plow, operated skillfully, can be used to minimize the rotary plow work that is slow and costly.

Two-way radios should be installed in all snow removal equipment which operate in remote areas to provide rapid emergency communication and promote more efficient snow and ice removal operations. Some low use equipment may be operated without installation of two-way radios, but may be equipped to use plug in or portable two-way radios. Personnel working in avalanche prone areas shall wear avalanche rescue beacons set to the “transmit” mode at all times.

### **R.05     Lights for Snow Equipment**

In addition to normal lighting, snow removal equipment may be equipped with special lighting equipment. Examples include: revolving amber lights, flashing amber lights, blade lights, spotlights, and fog lights.

- (A) In addition to the normal lighting equipment, chain control trucks and trailers should have the following:
  - (1) Two 8-inch flashing red lights visible from the rear.
  - (2) Two 4½ -inch white flood lamps on the rear, so as to illuminate the overhead chain check point sign.
  - (3) One 36- inch R1-1 (STOP) sign mounted on right rear corner of truck. It should be removable for traveling, or mounted so that it can be opened or closed to traffic.
- (B) Changeable message signs should be used when available to supplement other chain control equipment.

### **R.06     Care of Equipment**

When snow removal equipment is idle, it should be kept in good condition for quick starting.

Sheltered quarters may be provided where necessary.

Particular attention is directed to those items requiring lubrication every 8 hours, regardless of length of working shift.

Tire chains shall be inspected frequently and promptly repaired when they become worn or damaged.

Equipment shall be inspected and pre-operation checklists (“pre-ops”) shall be filled out at the beginning of each shift. When shift changes occur out on the road and the equipment will not return to the Maintenance station or shop, the operator shall review the latest pre-operation checklist. Post-operation checklists (“post-ops”) shall be filled out at the end of each shift. Equipment shall be hosed-off with water and serviced as needed at the end of each shift. Best Management Practices shall be used and storm water runoff issues shall be considered. It is the responsibility of supervisors and operators to see that snow removal equipment is properly serviced and maintained in top operating condition.

Extreme care should be taken by operators to avoid hitting bridges, berms, guardrail or other obstacles that may be hidden by snow. Operators should be aware of overhead height obstructions.

#### **R.07 Prevention of Drifts**

Identify locations subject to drifting and take preventative measures. The *Snow Fence Guide* by Dr. Ronald D. Tabler (SHRP-W/FR-91-106), available from the Federal Highway Administration (FHWA), includes detailed instructions regarding snow fences and reduction of drift.

The *Snow Fence Guide* states that “plowing snow drifts costs about 100 times more than installing effective snow fences.”

Proper trimming of trees may reduce drift formation at some locations. Planting of trees away from the roadway as outlined in the *Snow Fence Guide* is a cost effective and environmentally acceptable method of snow-drift reduction.

#### **R.08 Snow Fences**

Snow fence may serve a dual purpose. First, they reduce drifting problems. Second, they may decrease visibility problems where snow blows horizontally across the traveled way. Formal rights acquired through normal right of way processes should exist for all permanent highway features such as snow fences. See Chapter “C5” of this Manual, Section C5.20, “Entry Upon Private Property”, for instructions regarding permission to enter private property.

The proper position for fences will be determined by the local conditions, as wind currents vary in each locality. See the *Snow Fence Guide* for additional guidance.

## **R.09     Protection and Handling of Traffic**

It is the responsibility of Caltrans to determine chain requirements and post them.

Turnable permanent chain control signs shall be installed at strategic locations.

On heavily traveled major routes, flaggers and checkers may be necessary to aid in enforcing chain control and preventing excessive delay in the chaining up operation. CHP officers should be requested to aid in the enforcement aspects of chain control. In addition, District Traffic Operations personnel should be requested to help ensure the expeditious and orderly flow of traffic during chain control conditions through the application of traffic management techniques.

Private chain installers may be allowed if they are properly trained and have obtained the proper permits.

Often, mobile chain control units will be necessary due to rapidly changing conditions requiring changes in chain control locations. Portable highway advisory radios and changeable message sign units may also be necessary where traffic volumes are high.

It is absolutely mandatory that timely road condition reports be sent to the District Communications Center so that up-to-date road information is available to the public.

The Chain Requirements chart at the end of this chapter outlines standardized chain requirements. Under certain conditions, snow tires may be used on passenger vehicles in lieu of chains. However, those vehicles must carry chains of the correct size and type in case they are needed.

Chain or snow tire requirements must be made known to the local Zone and Area Commanders of the California Highway Patrol for purposes of proper enforcement.

A supply of the chain requirement charts shall be furnished to each Superintendent for distribution to truckers or others who may be concerned, and to Maintenance personnel responsible for chain control requirements.

Chain control signs must be changed promptly as conditions warrant.

(A) Conditions During Which Standard Signs are Required

There are four conditions for which standard signing for chain control areas are necessary.

- (1) R1A: The first condition may be used when road conditions are such that only single-axle drive vehicles with trailers need chains. (Commonly referred to as “Modified R1”). The sign shall be mounted below the CHAINS REQUIRED sign (R76).
- (2) R1: The second condition is when chains are required but autos and pickups with approved legal snow tires are exempted from using chains.
- (3) R2: The third condition is when chains are required but vehicles with four wheel drive (or all-wheel drive) and approved legal snow tires on all four wheels are exempted from using chains.
- (4) R3: The fourth condition is when chains are required with no exemptions.

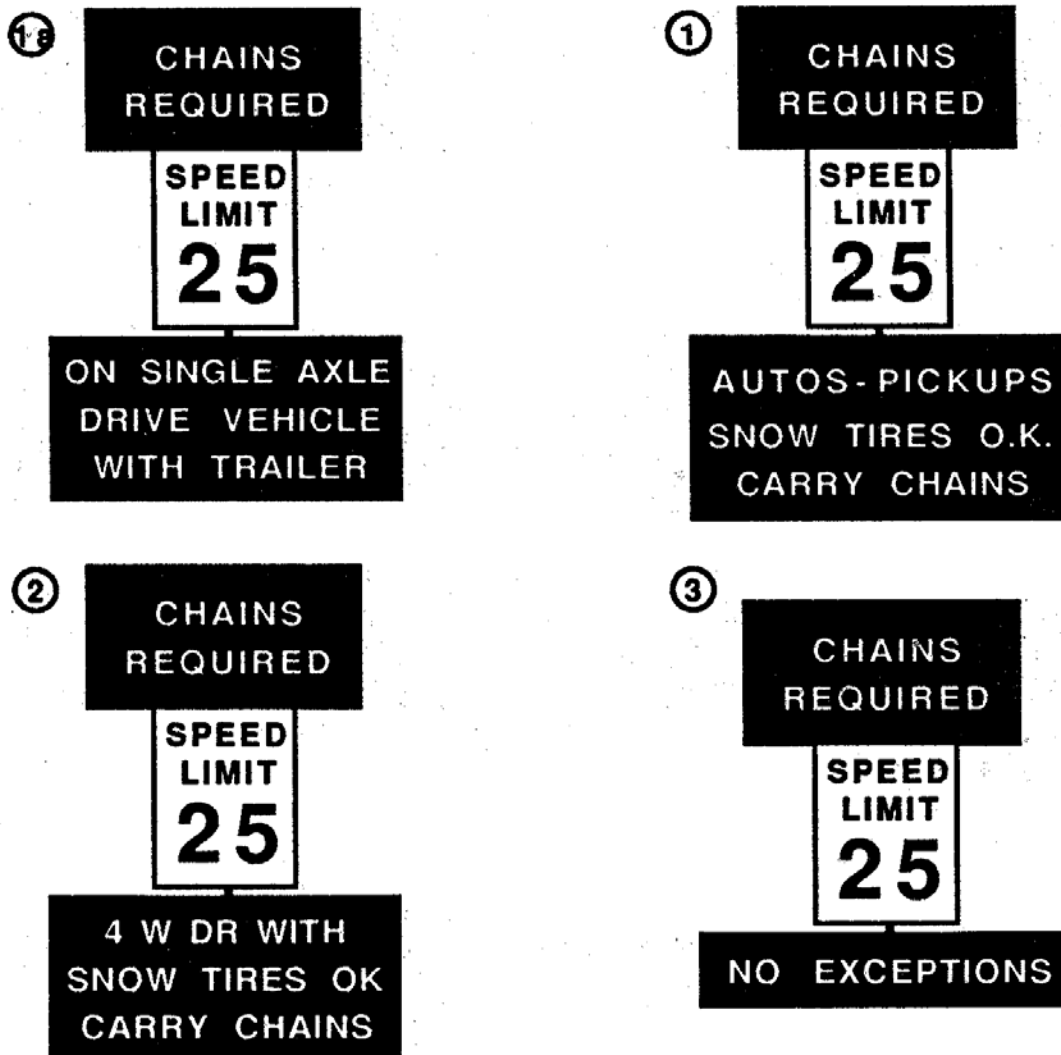


Figure R-2: Chain Requirements ("Speed Limit 25" is for illustration only)

Speed limits may be set at 40, 35, 30, or 25 miles per hour in chain control areas according to prevailing conditions as outlined in Section 22363 of the California Vehicle Code.

All designated areas should have "End of Chain Control" signs at the end of the chains required area.

### **R.10 Highway Condition Reports**

November 1 to April 30 is the normal winter season. During this time period, Highway Condition Reports (often referred to as Form 1013) need to be completed daily and consolidated in each district. They do not need to be sent to Headquarters.

### **R.11 Parking Areas**

As equipment becomes available after highway snow removal is completed, clearing of established parking areas on the right of way, and driveway berms, shall be done.

### **R.12 Sno-Parks**

Normally, clearing of Sno-Parks shall proceed only after State highways are open and equipment and personnel can be made available for such work. Exceptions are Sno-Parks that are used for snowplow turn arounds, or where it is impractical or inefficient to return at a later time. All Sno-Park work shall be documented for reimbursement according to the properly executed agreement in effect at the time. Supervisors are responsible for using the correct latest coding as instructed to ensure that resources spent on this work will be fully reimbursed to the Department. Inter-Agency Agreements for Sno-Park work are administered by the Headquarters Maintenance Program.

### **R.13 Sand and Deicing Chemical Storage**

Where ice, frost or snow cause slippery pavements, provisions for abrasives storage shall be made. Abrasives should be stored in covered stockpiles in areas where a frozen crust will not form on the stockpile. Where large quantities are required, and temperatures could get low enough to cause a frozen crust, a sand house or other structure may be provided. Deicing chemicals should be stored in covered areas, bunkers, abrasive storage buildings, or tanks, but they shall not be kept in equipment buildings. Abrasives and deicers should be stockpiled prior to and as needed during the winter season. Stockpiled material should be dry to prevent caking.

Deicing chemicals should be stored in compliance with the National Pollutant Discharge Elimination System (NPDES) standards. Contact the District NPDES (or Storm Water) Coordinator for further information on storm water pollution prevention measures.

#### **R.14 Applying Deicing Chemical and Abrasives**

Deicing chemicals and abrasives are spread to ensure the road is safe by providing increased traction to maintain an orderly flow of traffic during adverse weather conditions. Deicing chemical can be used to:

- (A) Prevent the formation of frost or ice films.
- (B) Weaken or prevent bonding between the snow pack and road surface.
- (C) Melt compacted snow that remains after plowing.

Sodium chloride (salt) is very effective above 25° F (-12.6° Celsius), fairly effective between 25° and 15° F (-12.5° and -30.6° Celsius), marginal between 10° and 15° F (-39.6° and -30.6° Celsius). It is not effective at all below 10° F (-39.6° Celsius).

Because of potentially detrimental effects of sodium chloride to vegetation, water quality and corrosion of metal, Maintenance personnel should use no more than the minimum amount necessary for effective snow and ice control as stated in the “Snow and Ice Control Policy.” All deicing products are to be applied under the strict control and direction of the assigned supervisor on duty unless prior authorization for a specific use has been given. A Material Safety Data Sheet (MSDS) will be kept on file for each deicing product being used.

(A) Application Guidelines

The following guidelines should be used when applying dry salt (Sodium Chloride-NaCl).

**DRY SALT APPLICATION RATES**

TEMPERATURE degrees Fahrenheit			RATE Pounds per lane mile		
With Falling temp F	In shade	In sun	To prevent ice films or to weaken bond between snow and road surface	To remove thin crusts of snow and ice after plowing	To remove thick crusts of snow and ice
	25-up	20-25	50 – 200	150	300
25-up	20-25	10-20	100 – 200	150 – 250	300 – 400
20-25	10-20	5	125 – 250	250	500

Salt may be made into brine by adding dry salt to water until an approximate 25% solution is achieved. The concentration of salt in the brine should be checked by use of a hydrometer. Brine should be used on trucks set up for this purpose to spray abrasives as they are applied. Proper use of brine can effectively reduce the total amount of salt and abrasives used in a given area.

Abrasives and/or chemicals will be used as needed on grades, curves, bridge decks, grade crossings, intersections, frost areas, and in cities and towns to improve vehicle traction.

Abrasives will ordinarily be applied at 1,000 lbs. or less per lane mile. Up to 2,000 lbs. per lane mile may be required on super-elevations or under unusual conditions. Applications should be repeated as necessary.

Spreaders should be calibrated at the beginning of the snow season to provide accurate application rates. To spread the desired amount of chemical and abrasive for given conditions, it is essential that the driver know the proper settings and speed to operate the equipment. Spreaders should be re-calibrated following mechanical repair or indications of inaccurate spreading.

Sand and salt shall be spread using an approved sander or salt spreader. On lightly traveled roads, the sander may be adjusted so that the full width of the pavement is covered in one operation from the right-hand lane. However, on roads having considerable traffic, it may be necessary to shield the sander so that the sand will be spread on only one lane at a time. Equipment used with sodium chloride should be washed and serviced at least once each shift and at all times immediately after each storm to prevent corrosion. Washing should only be done at approved rinse areas or wash racks according to appropriate BMP's.

### **R.15     Avalanche Control**

Certain highways are located in areas that are prone to avalanches. Three (3) systems are used to mitigate avalanche hazards by releasing them under controlled conditions.

- (A) GAZ-EX - a permanently mounted system of gas exploder tubes fired by remote control.
- (B) LoCAT - a semi-portable high pressure dry air propellant artillery type system.
- (C) Avalauncher - portable short range low pressure gas propellant artillery type system.

Explosive hand charges are used at remote locations under strictly controlled conditions when other methods are not appropriate or available.

Personnel involved in avalanche control shall be trained and licensed blasters certified to work with explosives.

Avalanche rescue beacons shall be provided to be worn at all times by Caltrans personnel working in avalanche prone areas. The beacons are to be in the "transmit" mode at all times. Two-way radios shall be used in all highway equipment and vehicles working in avalanche prone areas.

Specially designed jet roofs are ridge top structures used in some areas to redirect air currents to help prevent buildup of dangerous snow cornices. These are annually inspected and repaired to maintain structural integrity.

Caltrans works closely with the U.S. Forest Service, National Park Service, and private industry ski resort operators to ensure the public safety by posting warning signs restricting parking and off highway travel in avalanche prone areas.

## STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

## Chain Requirements

Revised 11/99



Vehicles are permitted in chain control areas when equipped with chains or Automatic Traction Device (ATD) as indicated.

Legal tread depth for mud and snow tires is 6/32" minimum.

Trucks with cable-type chains are legal in California. However, these trucks may be restricted at times due to local conditions.

The Department of Transportation

reserves the right to prohibit any vehicle from entering a chain control area when it is determined the vehicle will experience difficulty in safely traveling the area.

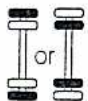


## LEGEND

- Driving axle
- Non-driving axle
- Wheel with chains or ATD
- Wheel with no chains
- Chains required on inside dual if possible
- Drive axle must be chained
- Chains on trailers may be staggered front and back
- Caltrans may require chains on all drive wheels if conditions warrant
- Both axes must be chained. (Four wheels with chains or ATD.)

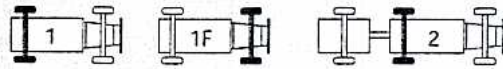
## NOTES

- All vehicles, including four wheel drive vehicles, that are towing trailers must have chains on one drive axle.
- Trailers with brakes must have chains on one axle.
- Front wheel drive vehicles must have chains on front (drive) axle.
- On any semi-trailer, only one set of chains is required regardless of number of axles.
- Chains are not required on tag axle.



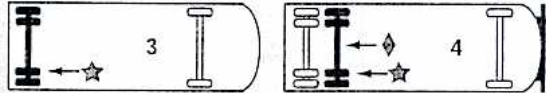
Acceptable on either axle of semi-trailers.

## AUTOS/PICKUPS



## BUSES/RECREATIONAL VEHICLES

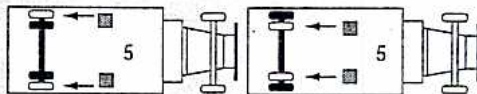
(Articulated buses must also chain outside wheels of last axle.)



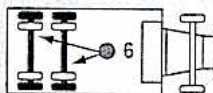
Type 2

Type 3

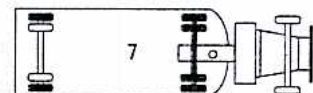
## TRUCKS



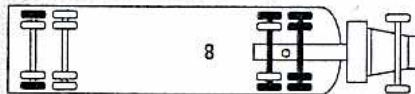
Truck Type 2



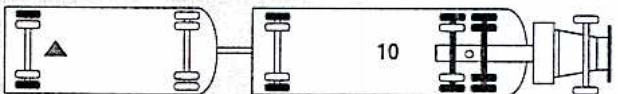
Truck Type 3



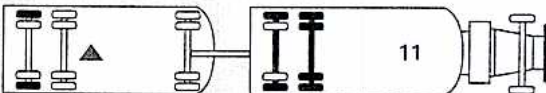
Tractor and Semi-trailer Single Dr.



Tractor and Semi-trailer Type 3-S-2

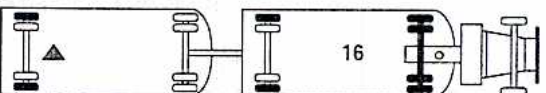


Tractor, Semi-trailer, and Trailer Type 3-S-1-T-2



Truck and Trailer Type 3-T-3 or 3-T-2

The following truck may be restricted when chains are required:



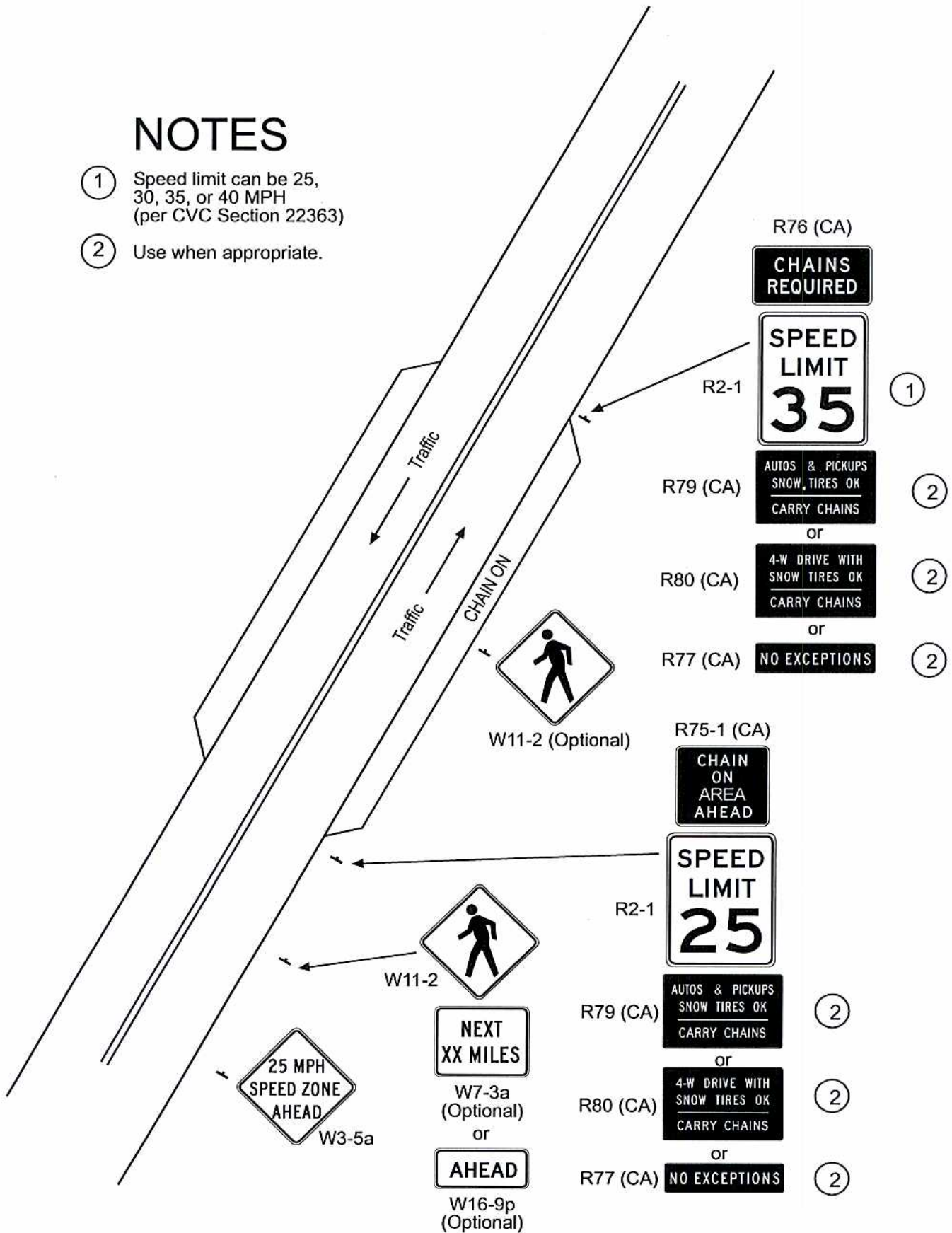
Tractor, Semi-trailer, and Trailer Type 2-S-1-T-2

For questions regarding these configurations, please contact the Caltrans Maintenance Program.

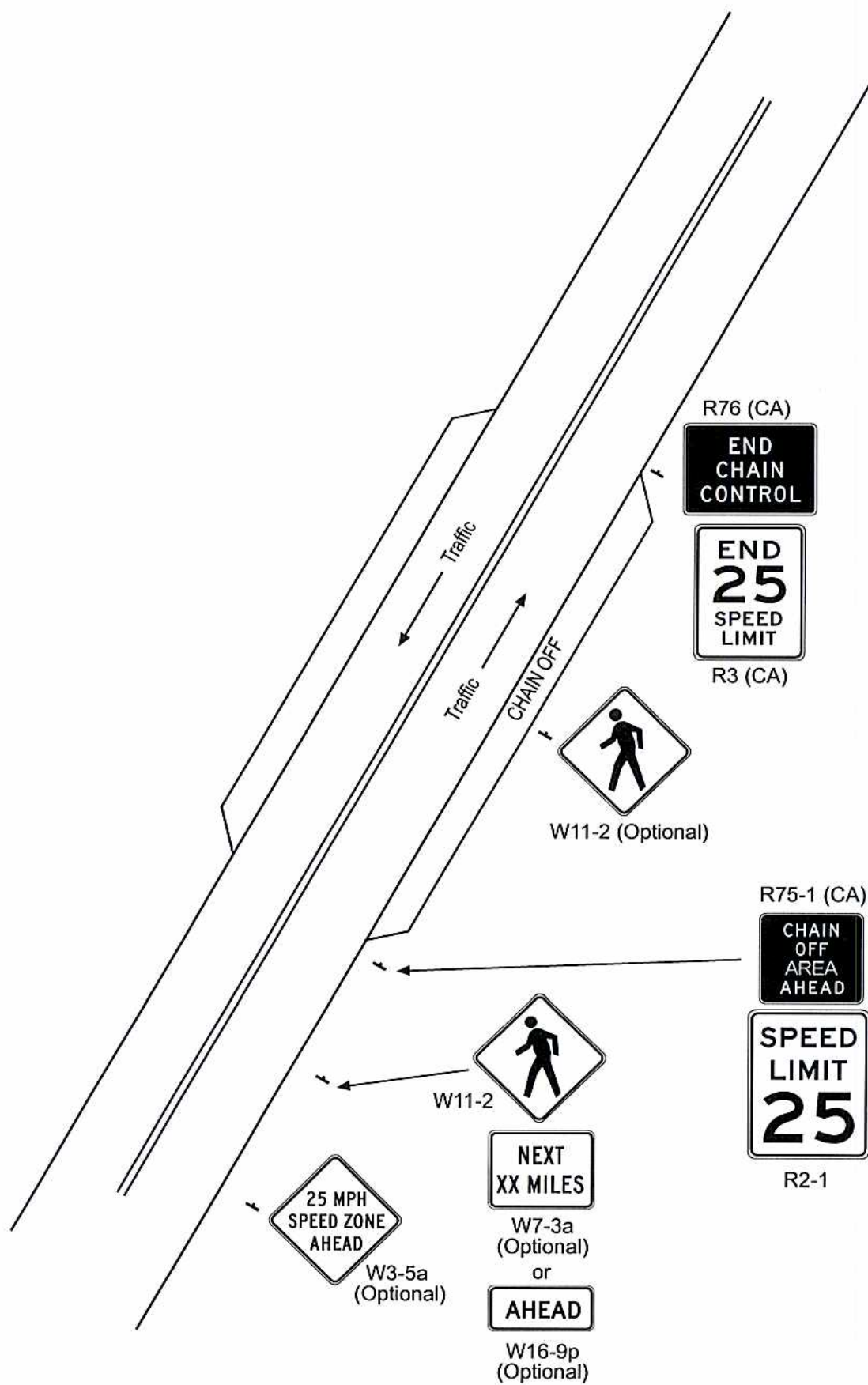
# TYPICAL SEQUENCING OF SIGNS IN CHAIN ON AREA ON A 2-LANE HIGHWAY

## NOTES

- ① Speed limit can be 25, 30, 35, or 40 MPH (per CVC Section 22363)
- ② Use when appropriate.



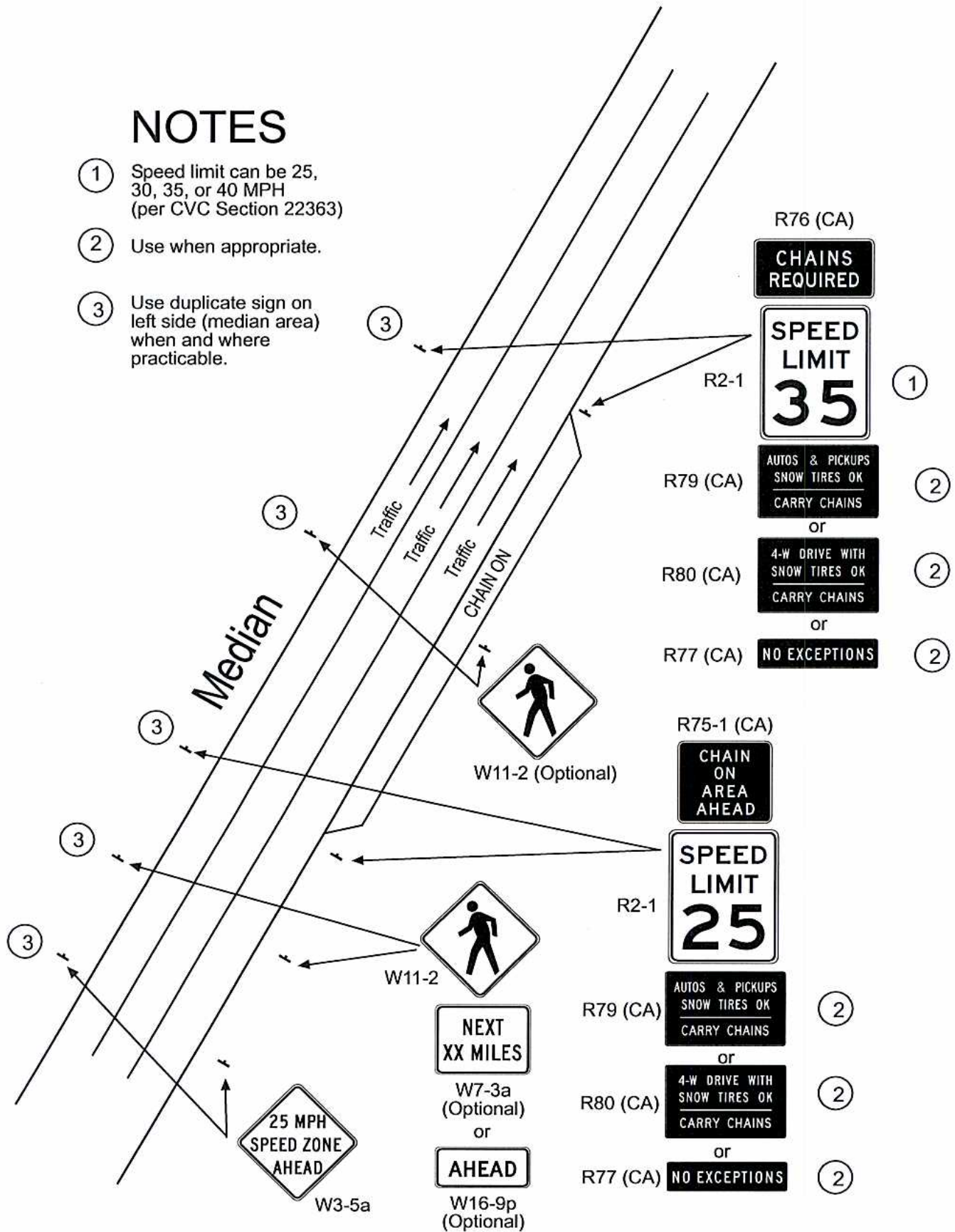
# TYPICAL SEQUENCING OF SIGNS IN CHAIN OFF AREA ON A 2-LANE HIGHWAY



# **TYPICAL SEQUENCING OF SIGNS IN CHAIN ON AREA ON A MULTI-LANE HIGHWAY**

## **NOTES**

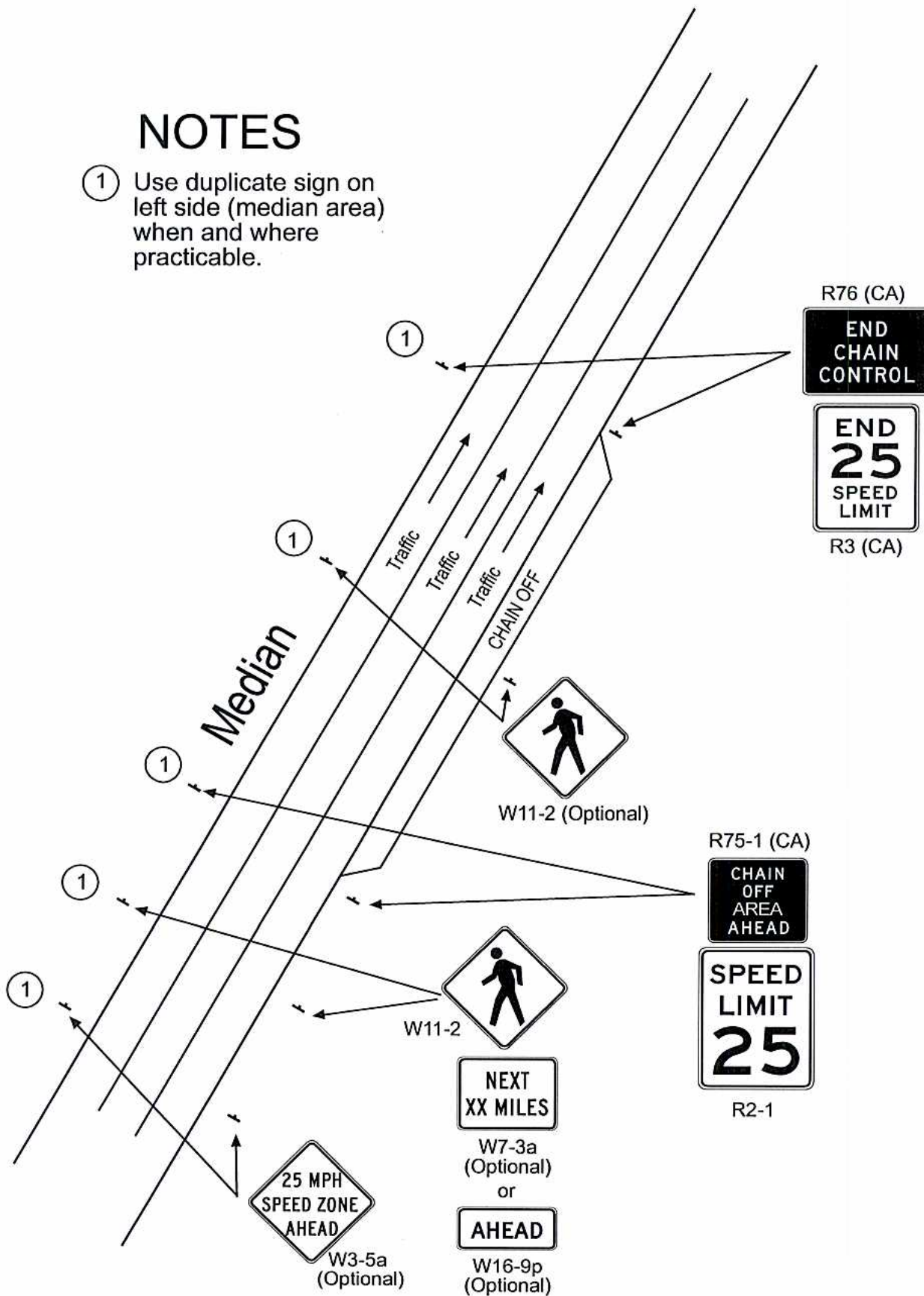
- ① Speed limit can be 25, 30, 35, or 40 MPH (per CVC Section 22363)
- ② Use when appropriate.
- ③ Use duplicate sign on left side (median area) when and where practicable.



# TYPICAL SEQUENCING OF SIGNS IN CHAIN OFF AREA ON A MULTI-LANE HIGHWAY

## NOTES

- ① Use duplicate sign on left side (median area) when and where practicable.



# CHAPTER S

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S.02	Photographs
S.03	Major Damage Response Phases
S.04	Major Damage Repairs by Contract
S.05	Timely Reporting of Damage
S.06	Day Labor Limit

Original signed by  
Susan Massey  
Office of Roadway Rehabilitation  
Division of Maintenance

## **S.00 Introduction**

Storm Damage and Other Major Damage includes all damage repair and re-openings related to natural disasters, catastrophes, or events such as storms, floods, wildfires, earthquakes, tsunamis (tidal waves), high surf, slope failures, or other geological phenomena. Response to man-made damage is included if it is on a large scale, such as riots, terrorism, or acts of war.

### **S.01 Charging and Documentation practices**

In cases of significant damage, Project Numbers must be assigned, and Work Orders must be site specific when reporting Storm Damage and Other Major Damage in the Integrated Maintenance Management System (IMMS).

Following established charging practices is critical to ensure full reimbursement from the federal government when disaster aid programs are in effect. Proper charging practices are required to meet federal regulations that specify minimum levels of cost tracking as a condition for receiving federal disaster aid. There is a direct relationship between the quality and accuracy of charging practices and the amount of funding that will flow back to district Maintenance.

Disaster declarations are often retroactive, so it is important to use correct charging practices at all times, whether or not a disaster is currently in effect.

Charging practice instructions for storm damage and other major damage are included in Maintenance Manual Volume 2, Part Two, “S” Family.

## **S.02     Photographs**

If your personal safety permits, take a photograph of the damage site prior to reopening or repair work. A photograph can make the difference between a site qualifying for reimbursement and not qualifying. Photos should be shared with the Maintenance Engineer, and should include a record of the location and date.

## **S.03     Major Damage Response phases**

There are two phases to Storm Damage and Other Major Damage response: Emergency Opening (EO) and Permanent Restoration (PR).

*Emergency Opening* includes first responder operations at the damage site taken to secure safety for travelers and workers, reopening of closed facilities to at least partial service, establishment of traffic control and detours, and prevention of additional damage if there is an immediate threat.

*Permanent Restoration* includes repair work to restore the damaged facility to its pre-event condition. Improvements or betterments may be included as part of Permanent Restoration if the purpose of the improvement or betterment is to prevent recurring damage.

Strategies for responding and repairing damaged facilities include:

- (1) State Forces; The Maintenance crew(s) perform all reopening and repair activities with State forces and State equipment. This is commonly used for smaller damage sites (small slides, removing rockfall, debris removal, restoring shoulder backing, etc.).
- (2) Split Strategy; The Maintenance crew(s) perform EO activities to partially or fully reopen the facility. Once secured, the site is left unrepaired until a capital contractor completes the Permanent Restoration project at a later date. This is frequently used for larger damage locations.
- (3) Combined Strategy; The Maintenance crew(s) respond initially but, because the site is too large or costly, the EO is completed by a capital contractor (typically by Director's Order). The EO and PR are completed in one step by the same contractor. The combined strategy is only used when it is economically advantageous because there is no clear "break" between EO and PR. Example: a complete washout of the whole traveled way. Once the contractor restores subgrade it is usually more efficient to continue on to paving and striping, rather than trying to divide the work into a separate EO contract and PR contract.

#### **S.04 Major Damage Repairs by Contract**

The Department has mechanisms to fund major damage repairs by contract. Maintenance supervisors should use judgment to determine whether or not damage repairs are best done by capital contract. Damage repairs needing an engineered solution, would consume too much of the crew's time (causing neglect of other needs in the area), or require extensive equipment rental should be considered for completion by capital contract.

Types of contracts available are listed for information only. Capital contracts are generally handled by the District office, except for Equipment Rental (no. 3 below):

- (1) Director's Orders. Emergency contracts, approved by Headquarters, initiated by Maintenance but administered by Construction. See Deputy Directive DD-26R.
- (2) Emergency Public Works Contracts ("Minor B"). Emergency capital contracts below the cost threshold (currently \$120,000) for a Director's Order are delegated to the district. Refer to your district policies and procedures.
- (3) Emergency Equipment Rental Contracts may or may not be capital funded on case-by-case basis, and may only be used for debris removal, basin cleanout, culvert unplugging, or non-engineered excavation/backfill. Do not use Equipment Rental contracts to construct repairs. These contracts do not have the correct legal boilerplate for general construction. Emergency Equipment Rental Contracts may also include dump fees. State law requires that Emergency Equipment Rental Contracts have a term not exceeding 60 days.
- (4) Form 42 Emergency Materials Procurement. Innovative procurement-in-place methods may be made available following declared disasters. A Governor's Executive Order is generally required. Non-disaster Form 42 procurement is possible on a case-by-case basis, but requires Department of General Services approval via the Division of Procurement and Contracts.

#### **S.05 Timely Reporting of Damage**

Immediate reporting of damage through your established chain of command is essential to ensure the most timely and efficient response. Refer to the *Emergency Operations Manual* for more information.

**S.06 Day Labor Limit**

**State law prohibits State forces from performing certain types of project work in excess of \$25,000 per project. Storm Damage and Other Major Damage is not subject to this prohibition. The \$25,000 limit does not apply to S Activity work.**

# CHAPTER U

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Appendix U1	Highway Condition Reporting Guidelines

Original signed by  
Ferdinand Milanes  
Office of Radio Communications Engineering  
Division of Maintenance

## **U.00 Introduction**

This Chapter contains information concerning Telecommunications.

## **U.01 Telecommunications**

Caltrans telecommunications functions are divided into two sections; engineering and operations.

The Office of Radio Communications (ORC), under the Division of Maintenance, monitors district telecommunication requirements, and provides system design, acquisition, installation, and maintenance of communication equipment. Improvements, changes and additions to the communications systems are accomplished in cooperation with the districts. More information about the products and services provided by the ORC can be found on the Caltrans Intranet by going to Caltrans ONRAMP, selecting "Internal Programs/Divisions/Districts", then selecting "Maintenance Radio Communications". Select "Telecommunications Manual".

The Headquarters Communications Center, under the Division of Traffic Operations, performs the following functions:

- (A) Monitors statewide radio and the California Highway Patrol Computer Aided Dispatch (Media CAD).
- (B) Operates the Caltrans Highway Information Network (CHIN).
- (C) Assist the Headquarters Emergency Operations Center during emergencies.

**U.01.1 License Requirement**

**(A) Operator License**

Caltrans personnel may be authorized to operate licensed land and mobile radio stations in the Highway Maintenance Radio System during the course of their duties without holding a license or permit issued by the Federal Communications Commission (FCC). Such authorization does not diminish in any respect, the responsibility of Caltrans to maintain control over the stations licensed to them, or for the proper function and operation of those stations in accordance with the terms of the license.

**(B) Station License**

No radio station shall be operated in the Highway Maintenance Radio System except in accordance with a valid authorization for that station as issued by the FCC. It is the responsibility of the ORC to furnish any required station authorizations to the districts for proper posting in accordance with Part 89.167 of the FCC rules and Regulations.

**U.01.2 Radio Station Inspections**

All radio stations and records of radio stations in the Caltrans Radio Communications System shall be made available for inspection at any time while the station is in operation, or shall be made available for inspection upon reasonable request of an authorized representative of the FCC.

**U.01.3 Telecommunications Equipment Inventory**

Each District Radio Coordinator is responsible for the district's telecommunications inventory. These responsibilities include; notifying Headquarters of all equipment status changes, taking annual physical equipment inventory, and ordering replacement components. The Telecommunications Property Manager in the ORC is available to assist with district inventories.

The ORC will assist the district coordinator in purchasing, storing, shipping, and receiving all district communication equipment, spare parts, and components. All district communication equipment not in service should be stored at the ORC warehouse, or at a location deemed appropriate by the Radio Coordinator. Stored equipment will fall into several categories including; district storage, pending stock awaiting shipment to the ORC, district assignment, or spare parts.

Status changes on equipment will be sent to the Property Manager at the ORC for updating of the computerized master telecommunications inventory. The District Radio Coordinator will receive various updated computer printouts showing current inventory status.

During the third quarter of each fiscal year, the districts shall submit a list of telecommunications equipment required for the next fiscal year.

**U.01.4            Caltrans Auxiliary Radio System (CARS)**

The Division of Maintenance is responsible for the management and coordination of the Caltrans Auxiliary Radio System. This consists of both equipment and a list of Caltrans employees who are volunteer amateur radio operators. These operators provide Caltrans with emergency communications in the event the normal communication methods become overburdened or non-existent.

The Caltrans Auxiliary Radio System (CARS) is affiliated with the Governor's Office of Emergency Services (OES), and the Radio Amateur Civil Emergency Service (RACES) which has lead responsibility for government agencies. The RACES Coordinator, appointed by the Division of Maintenance, will be the contact person for OES.

**U.01.5            Caltrans Highway Information Network (CHIN)**

**(A)    Headquarters Communications Center**

- (1) The Headquarters Communications Center receives statewide highway condition information from the districts via telephone, fax, email, Lane Closure System (LCS) and the CHP Management Information System computerized message reports. This updated highway condition information; made available 24-hours a day, seven days a week, includes restrictions, closures, re-openings, spills, extraordinary accidents, and unusual occurrences, and is available to the public via the Internet and telephone. CHIN provides continually updated information on the statewide highway system to assist the traveling public in making informed travel decisions.

(B) Policy

- (1) The Caltrans Division of Traffic Operations shall have a communications center responsible for collecting and disseminating statewide highway condition information.
- (2) Each district shall have a communications center responsible for collecting and disseminating district-wide highway condition information.
- (3) District Traffic Management Centers, as applicable, and their respective District Public Information Offices shall work closely together to ensure current highway condition information is promptly provided to the Headquarters Communications Center.
- (4) The Director's Office, the District Public Information Office, the Federal Highway Administration, and various other agencies shall be promptly informed by the Headquarters Communications Center when there are extraordinary accidents or unusual occurrences such as natural disasters, bomb threats, or mass demonstrations.
- (5) Accurate and timely information must be made available to the news media through close coordination of Headquarters and the District Public Information Offices. The Public Information Office shall provide information to the news media.
- (6) In cases of an extraordinary number of public inquiries on a particular highway condition, and when this condition is expected to continue for an extended period of time, Headquarters Communications Center shall ask District Public Information Offices to provide a referral telephone number. This number shall be included on the appropriate CHIN recording(s) until the condition changes and/or there is no longer a need for the number.
- (7) The Headquarters Communications Center shall notify affected districts when conflicting highway condition or emergency information is received from districts. The District Public Information Offices and District Traffic Management Centers shall complete a consistent report as soon as possible to ensure information provided to the public and/or media is accurate.
- (8) The Headquarters Communications Center shall inform Caltrans managers, Headquarters Public Information Office, outside agencies, and the public of emergency and highway condition information according to agreed upon procedures.

- (9) District Traffic Management Centers, as applicable, and their respective District Public Information Offices, shall promptly inform the Headquarters Communications Center of all reportable incidents as outlined in the Department of Transportation Highway Condition Reporting Guidelines.

## **Appendix U1**

### **DEPARTMENT OF TRANSPORTATION** **HIGHWAY CONDITION REPORTING GUIDELINES**

The California Department of Transportation (Caltrans), Division of Traffic Operations operates the Headquarters Communications Center 24 hours a day, seven days a week. The Headquarters Communications Center functions as a central focal point for current highway condition information and distributes status reports to the public via the Caltrans Highway Information Network (CHIN) and the Internet.

The Headquarters Communications Center also maintains and utilizes critical Caltrans contact lists, e.g., Weekly Duty Officer List, and Earthquake Notification Report, and is responsible for notifying management of the ever-changing condition of the Highway System and reporting incidents involving departmental resources. The Headquarters Communications Center has direct communication links with all twelve districts within Caltrans.

In order to achieve the strategic goals and mission of the Department, the following procedures and responsibilities are being reissued.

#### **HEADQUARTERS COMMUNICATIONS CENTER RESPONSIBILITIES**

The primary function of the Headquarters Communications Center is to promptly disseminate accurate information to the motoring public via the CHIN and Internet system. Each district within the Department operates a District Maintenance Communications Center (DMCC) or District/Regional Traffic Management Center (TMC). These centers are the primary source of current statewide highway condition information. Therefore, it is imperative the Headquarters Communications Center receive accurate and timely information and updates from the districts.

In addition, the Headquarters Communications Center informs the Secretary and Undersecretary of the Business, Transportation and Housing Agency, the Governor's Office of Emergency Services, the Directorate of the Department of Transportation, and designated staff of the current highway conditions.

## **DISTRICT RESPONSIBILITIES**

District Directors will ensure the appropriate information, as described below, is reported to the Headquarters Communications Center by their DMCC/TMC accurately and timely.

District Maintenance and Construction personnel are to promptly report incidents directly to their DMCC/TMC prior to making any report of traffic conditions, incident and/or emergency to any other State agency or private business, e.g., traffic reporting companies, radio or television broadcasters, ski areas, or newspapers. Notification of fire, law or medical responders may preempt this priority. The DMCC/TMC can provide assistance in emergency notification and should be utilized.

The DMCC/TMC will immediately notify the Headquarters Communications Center via telephone of all reportable incidents prior to notification of any other State agency, private business, or media.

## **REPORTABLE INCIDENTS**

The Headquarters Communications Center will be immediately notified by telephone if any of the following events occur on interstate highways, U.S. highways, or State routes.

1. Closure and reopening of highways, connector ramps, or transition roads. A closure is when all lanes are closed, each direction, on divided highways regardless if there is a detour.
2. Non-recurring incidents that impede the normal flow of traffic and projected to last for more than thirty (30) minutes.
3. Chain control limits and/or conditions when established or when there is a change in chain control limits and/or conditions (R1 to R2).
4. Spills of any reportable hazardous or unidentified material.
5. Any damage to a bridge, over-crossing, under-crossing, or tunnel caused by any vehicle, floating object, airplane, storm, or other natural cause.
6. Unusual or extraordinary occurrences. Examples of unusual or extraordinary occurrence follows, but are not limited to the examples given.
  - a) Any incident resulting in one or more fatality.
  - b) Any commercial vehicle accident (bus, train, truck, or airplane) on or adjacent to a highway maintained by the Department.

- c) Any chain reaction accident caused by, but not limited to dust, smoke, snow, fog, and blowing or drifting sand.
- d) Any vehicle accident that occurs within a highway construction project or Maintenance work zone, which involve a fatality or an ambulance-transported victim.
- e) Any incident which involves damage to any vehicle, equipment, or facility of the Department.
- f) Any incident which results in death or injury to an employee of the Department or contractor working for the Department.
- g) Natural or man-made disasters or emergencies which result in highway restriction or damage. Natural disasters would include, but are not limited to, earthquake, flood, tornado, tidal wave, volcanic eruption, forest fire, avalanche, and any type of slide. Man-made disasters would include, but are not limited to, arson, bomb threat, sniper attacks, or mass demonstration.
- h) Any situation on or near a highway which necessitates the evacuation of the immediate area.
- i) Significantly impaired visibility caused by fog, dust, smoke, blowing or drifting sand or other conditions.
- j) Any incident that affects a highway or facilities that may generate media coverage.
- k) Response to an American Missing Broadcast Emergency Response (AMBER) alert request from the California Highway Patrol.

## **REPORTING REQUIREMENTS**

The DMCC/TMC will promptly forward reportable incident information to the Headquarters Communications Center upon receiving incident information from region Maintenance crews, Maintenance stations, region offices, Construction, Traffic Operations, or other official source.

The following incident information will be included in the initial report and any subsequent update:

1. Name and unit of the person from the reporting location.
2. District, county, route and post mile. If the route affected is a transition or connector ramp, it would be reported as, for example, "The connector ramp from southbound Interstate 5 to eastbound State Route 91". Interstate 5 would be considered the affected route.
3. Geographic location of restriction. The geographic location must be one easily found on a map or that is signed at the location. Do not use local names, such as "Joe's Corner", "the upper four lane", or "mouth of the canyon", etc.
4. Type of restriction, such as closures, one-way, etc.
5. Date and time the restriction occurred, not the time the reporting agency was notified. The actual occurrence time is required.
6. The reason for the restriction.
7. Advise if there is a detour available.

NOTE: Detours must be posted or otherwise clearly stated to the public. If there is not a specific detour in place, advise Headquarters Communications Center and the message to motorists will be "Motorists are advised to use an alternate route."

8. The estimated time of partial reopening and/or full reopening (include the estimated delay to public).
9. Add all pertinent information received to the report.

NOTE: When the effects of the incident being reported crosses district boundaries, the reporting district is responsible for notifying the adjacent district(s). The districts will coordinate with each other and the Headquarters Communications Center.

The DMCC/TMC will promptly forward hourly updates on reportable incidents to the Communications Center.

**OCCURRENCES OUTSIDE NORMAL WORK HOURS**

Some DMCC/TMC are not staffed 24 hours a day, seven days a week. During periods when major storms and/or unusual circumstances occur, the DMCC/TMC should be staffed to provide timely and accurate information to the Headquarters Communications Center.

# CHAPTER Y

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Original signed by  
Patti-Jo Dickinson  
Maintenance Liaison  
Division of Maintenance

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## **SECTION 1: POLICY**

### **Y.00 Introduction**

Work for Others is defined as any work performed under specific requests and authorizations by other Divisions, such as Traffic, Environmental, Construction, Right of Way, Equipment and others within the Department of Transportation (Caltrans). Work for Others includes work for other entities, departments and institutions within State government.

For other entity work, Caltrans usually enters into written agreements that outline the work to be performed and specifies the expenditures authorized.

Refer to Maintenance Manual Volume 2, “Y” Family, for a detailed description of planning, scheduling, administration, and the appropriate charging practices for activities contained in this chapter.

Work for Others can include charging to established Expenditure Authorizations (EAs) within fiscal year cross allocation agreements, and work for which the Maintenance Division gets reimbursed.

Maintenance forces should provide service only when a valid EA is made available so that workload that should be funded by others does not get absorbed by Maintenance funded resources.

### **Y.01 State Park Roads**

It is Caltrans policy to require the Department of Parks and Recreation to finance all work on roads in State Parks that are under their jurisdiction. While such work is not financed from State Highway Funds, it may be performed by Caltrans forces under authority of an Interagency Service Agreement (Standard Form 13), and is covered by 926XXX Expenditure Authorizations.

The work to be performed must conform to the work that is authorized in the Interagency Agreement, and is to be restricted to the locations specified therein. Work is not to be undertaken without written request from the local Park Superintendent. Such request will not require advance approval by the Maintenance Division.

Agreements should be written to specify that routine patrol and surveillance activities are to be performed by the Department of Parks and Recreation. Written requests from the Park Superintendent should then outline the desired work, and specify the expenditure authorized therefore. Such authorized expenditures are not to be exceeded without prior approval by the Department of Parks and Recreation or Park Superintendent. Also, the overall expenditure must not exceed funds allotted under the 926XXX Expenditure Authorization. Every effort should be made to expedite billings to the Department of Parks and Recreation to permit them to re-allocate unexpended balances to other needed work.

Special consideration should be given in the agreement for the possible need of a periodic, in-depth, inspection of bridges and structures by the technical staff of the Caltrans Division of Structures. At this time, it is unlikely that the Department of Parks and Recreation has adequate personnel qualified to inspect and recommend future preventative maintenance needs. The basic agreement should include a statement that needed inspections are authorized without the need for additional written requests from the Park Superintendent.

## **Y.02     Work for Other Entities--"926" Authorizations**

Accommodation work may be performed for individuals, firms, or political subdivisions of the State.

Funds, sufficient to cover the estimated cost must be deposited by an individual, or firm as a prerequisite. Work for a city or county may be arranged for under cash deposit, special agreement, or purchase order. Work for other State agencies is usually authorized by execution of Standard Form 13, Interagency Service Agreement. This agreement constitutes a contract entered into by Caltrans and the other entity and, as such, must be rigidly adhered to as to amount, type and extent of work to be performed, time limits, etc. No deviation from the terms of an Interagency Service Agreement is permitted without the approval of the contracting agencies and the Department of Finance.

The work to be performed under any of the above arrangements is not to be undertaken until the work order is issued or advance approval is otherwise obtained. "Blanket" work order numbers for recurring work performed by Maintenance forces occur in EA's 930XXX. Current blankets can be checked with your District Project Control Officer. Consecutively numbered specific "926" work orders are issued for work not covered under the assigned blanket allotments. All of these work orders are used in conjunction with the Integrated Maintenance Management System (IMMS) "Y" Family on the IMMS Work Order.

### **Y.03 Minor Improvement or Betterment Work**

New construction (Minor improvement or betterment work) when performed by Maintenance forces, is under the control of the Division of Construction.

Small project requests, or minor construction allotments performed under "Day-Labor", and the final reports shall be submitted in the prescribed format, as per the Division of Construction. Minor construction, improvement or betterment work, if requested by others and performed by Maintenance forces, is considered "Day Labor" and is subject to maximum limits imposed by State law (Government Code 10122.6). This law limits the value of minor construction, improvement or betterment work performed by Maintenance forces to be no more than \$25,000 per project. Otherwise, the requesting office should obtain a contractor. The \$25,000 limit may be waived, but requires an approved Headquarters Director's Order.

Work done at the request of others that would normally be considered routine maintenance is **not** considered Day Labor. Example: Traffic Operations requests trimming of roadside vegetation to improve sight distance at the apex of a curve. This is not subject to the Day Labor law because the nature of the work is routine maintenance.

Work done at the request of others that is subject to the Day Labor law includes new construction, improvements and rehabilitation. Examples include:

- (A) Improve grade or widen roadbed, including shoulders.
- (B) Correct sub-drainage, stabilize base, import select materials on sections with poor base.
- (C) Improve sight distances.
- (D) Extend old or install additional or larger capacity culverts.
- (E) Benching or flattening cut slopes in connection with slide or slipout correction.
- (F) Improve bridge decks.
- (G) Install guardrail or other safety devices.
- (H) Place rip-rap, slope paving, etc., for erosion control or bank protection.
- (I) Installation of horizontal drains.
- (J) Installation of new traffic control signage.

State law requires Final Completion reports to be kept on file for all Day Labor work in excess of \$15,000. See Chapter 2 of this manual for more information.

**Y.03.1          Final Reports on Contracts and Day Labor Work**

Final reports on all contracts financed under Minor Improvement Betterment, or other Construction funds are to follow the form prescribed by the controlling office. Final reports for Day Labor work in excess of \$15,000 are required. See Chapter 2 of this manual for more information.

**Y.04          Work for Division of Right of Way**

Work for the Office of Right of Way on excess lands, or in fulfillment of a Right of Way obligation subsequent to construction, shall be undertaken, only upon instructions from the District Right of Way Agent as per the R/W work order, against which the charges are to be applied. Such work located outside of operational highway right of way shall be limited to such items as weed clearance, removal or diseased trees, the building of barricades, and filling of dangerous holes. Building of right of way chain link fences shall not be included in this category of work.

## **SECTION 2: ENCROACHMENT PERMITS**

### **Y.05 Introduction**

Caltrans is vested with full possession and control of all State highways, and all property and rights in property acquired for State highway purposes pursuant to Sections 90 and 92 of the Streets and Highways Code.

All work performed under the Maintenance Family "Y5" is administered by the Office of Encroachment Permits, Division of Traffic Operations.

In order to preserve capital investment, ensure maximum safety to the traveling public and protect adjacent property, legislative and policy limitations have been placed on the use of highway right of way.

Exceptions to these limitations can only be authorized under an encroachment permit issued after a thorough evaluation has established that the exception is not contrary to public interest or safety.

### **Y.06 Maintenance Levels**

The efficient processing of encroachment permit applications is necessary to provide a proficient level of service and to maintain good public relations.

Work performed under an encroachment permit should be inspected to ensure compliance with Departmental standards and encroachment permit conditions.

#### **Y.06.1 Statutory Authority**

Authority to control encroachments within State highway right of way is contained in Chapter 3, Division 1, Articles 1, 2, 2.5 and 3 of the Streets and Highways Code. Definitions of the term "highway" and "encroachment" are quoted from Section 660 of said Code as follows:

- (A) The "highway" includes all or any part of the entire width of right of way of a State highway, whether or not such entire area is actually used for highway purposes.

- (B) The term “encroachment” includes any tower, pole, pole line, pipe, pipeline, fence, billboard, stand or building, any structure or object of any kind or character not particularly mentioned in this section, or special event, which is placed in, under, or over any portion of the highway. “Special Event” means any street festival, sidewalk sale, community-sponsored activity, or community-approved activity.

**Y.06.2            Encroachment Permits Manual**

The Division of Traffic Operations, Encroachment Permits Office has developed the "Encroachment Permits Manual" which contains policy, procedures, and rules and regulations for use in issuing encroachment permits. This manual should be consulted for detailed information concerning encroachment permits.

**Y.06.3            Work Requiring Permits**

It is unlawful for any person to perform any of the following acts within State highway right of way without first applying for and obtaining an encroachment permit from the district office having jurisdiction over that State highway involved for :

- (A) Make an opening or excavation for any purpose in any State highway.
- (B) Place, change or renew an encroachment.
- (C) Place or display in, under, or over any State highway, any kind of advertising sign or device.
- (D) Plant, remove, cut, cut down, injure or destroy any tree, shrub, plant or flower growing within any State highway.
- (E) Install or remove tire chains upon motor vehicles for compensation.
- (F) Occupy State highway right of way for any use or purpose or interfere with or obstruct highway traffic in any manner not authorized by law.

The State may require a permit and bond for, or require the removal of any encroachment in or on any part of a State highway. Bonds are generally not required from public agencies as provided for in Section 678 of the Streets and Highways Code.

**Y.06.4          Salvage Operations**

When an owner or authorized agent requires or is required to return to the scene of an accident for the purpose of salvage operations (i.e. clean-up of a spilled load, removal a wrecked vehicle, etc.), and these operations can be performed within a 24 hour period, the Maintenance Superintendent's Office shall issue a "Letter of Consent" (form TR-0131). In addition, a transportation permit is required for over-length or over-weight tows.

A Letter of Consent is not required in cases where:

- (A) The life or safety of vehicle occupants is involved.
- (B) It is to recover victims.
- (C) Wrecked vehicles or their loads are blocking the highway.
- (D) A law enforcement officer orders removal from highway right of way.

**Y.06.5          Chain Installer Operations**

In accordance with Streets and Highways Code, Section 670, individuals are allowed within the highway right of way, under an encroachment permit, for the benefit of the traveling public and Caltrans for the purpose of installing and/or removing snow chains.

Revocation of this Caltrans Encroachment Permit is at the discretion of law enforcement or any State representative for the purpose of illegal behavior or public safety. The District Permits Engineer shall be notified immediately.

**Y.06.6 Business or Private Property Road Approaches**

A property owner (private or commercial) or their authorized agent in control of the property desiring to construct access (i.e. driveway or road-approach) to a State highway, shall apply for and obtain an encroachment permit. It is the responsibility of the property owner to maintain the approach from their property line up to the improved shoulder of the highway.

When ownership of lands adjacent to a State highway changes, the new property owner may or may not be aware of their responsibilities for maintaining the approach to their property. When given the opportunity, district forces should inform these new owners of their responsibilities and their requirement to apply for and obtain a new encroachment permit for “record purposes only.”

Encroachment permits are not “property rights.” An encroachment permit is a tool utilized by Caltrans to grant or allow permission to access onto State highway right of way for the purpose of conducting an activity, and are revocable for non-compliance of the permit conditions or for reasons of public safety.

The property owner or their authorized agent should be notified of the ramifications of when an encroachment permit is revoked. Revocation of a permit should be utilized only as a last measure, and with the approval of the District Permits Engineer.

**Y.06.7 Public Road Approaches**

When public roads (city or county) intersect with a State highway, it is the responsibility of Caltrans to maintain that portion of the intersecting public road within State highway right of way.

An encroachment permit is required whenever public entity or agency work forces desire to perform maintenance of their existing facilities that are within State highway right of way, unless otherwise stipulated within a Maintenance Agreement.

When a public roadway intersection is separated by a structure, maintenance in these locations will be as stipulated within the Maintenance Agreement with that public entity.

New construction of a public roadway intersecting with a State highway shall be constructed to meet Caltrans standards for the type and volume of traffic expected.

Local entities shall provide adequate signage and safety devices (directional or warning signage) as required by the Caltrans District Traffic Engineer for traffic entering State highway right of way from new intersecting road constructed.

Y.06.8 Rural Mailboxes

The placement of rural mailboxes within State highway right of way is permitted under an encroachment permit for the convenience of the public.

The following postal regulations apply to rural mailboxes:

POSTAL MANUAL  
U.S. Post Office Department  
Section 156.54 - Location

Rural boxes, must be placed so that they may be conveniently served by carriers without leaving their conveyances, and must be located on the right-hand side of the road in the direction of travel of the carriers in all cases where traffic conditions are such, that it would be dangerous for the carriers to drive to the left in order to reach the boxes, or where doing so, would constitute a violation of traffic laws and regulations. On new rural routes, all boxes must be located on the right of the road in the direction of travel of the carrier. Boxes must be placed to conform with State laws and highway regulations. Patrons must remove obstructions, including snow, that make delivery difficult.

Section 156.55 - Grouping

Boxes should be grouped wherever possible, especially at or near crossroads, or at other places where a considerable number of boxes are located.

Persons desiring the benefits of service on a rural mail delivery route are required by the Post Office Department to furnish, erect, and properly maintain mailboxes for the reception of mail. The Department wishes to cooperate with the Postal Service in permitting mailboxes at locations convenient to mail carriers and, at the same time, not interfere with highway maintenance operations.

Owners of mailboxes are encouraged to place them in a group, so that they can be serviced by the carrier, at one stop. Where a group installation is already in place, a new box owner should be required to install his box in the same location. New installations are preferred on the far right-hand side of an intersection.

Maintenance forces shall provide suitable surfacing between the roadway and a group of mailboxes. This surfacing shall conform to the adjoining shoulder material, except where there is an earth shoulder. In this case, sufficient gravel surfacing may be placed.

Mailboxes shall not be positioned so as to obscure highway signs or interfere with maintenance operations.

Supports for mailboxes should be a breakaway or a forgiving design. Generally, the wood support, if without breakaway modification, should be no larger than 4 inches x 4 inches. Maximum inside diameter of steel pipe should be no more than 1½ inches. Axles, plows, crankshafts, etc. should not be used, as they are potentially severe to hit. Multiple box installations should be located, where possible, off of the State highway. If this is not possible, individual supports for each mailbox shall be used.

Mailboxes and supports shall be manufactured according to U.S. Post Office specifications.

Mailboxes on Freeways - Except in unusual circumstances, mailboxes will not be allowed on new expressways or full freeways. When a freeway is constructed on new alignment, there will be no mailbox problem, as access rights have previously been acquired, and a new highway in this category would not be selected for a rural mail route. In cases where a two-lane highway is converted into an expressway with access controlled, mailboxes must be removed and erected on the new rural mail route, which will be established on frontage roads. When no frontage road has been provided, rural mailboxes may be placed at a convenient location near an interchange or grade separation structure. The most desirable location at an interchange would be on county road section beyond the highway right of way.

However, the exact location should be determined by the district in cooperation with the local Postmaster.

These requirements also apply to newspaper boxes where appropriate.

#### **Y.06.9      Inspection and Report on Permits**

Inspection of permitted work is generally by an Encroachment Permits Inspector. However, in some locations, a Maintenance Area Superintendent or Maintenance Supervisor may perform inspection of the permitted work.

Specific types of permitted work require a greater degree of inspection. In those cases, it is the responsibility of the District Permits Engineer to ensure that adequate and competent inspection is provided.

Violations of permit conditions or public safety shall be reported immediately to the District Permits Engineer, and a notification of such violations given to the permittee in writing.

**Y.06.10      Franchise**

A franchise may be granted by a city or county for another entity to operate on their behalf. In some cases this may include such operations within State highway right of way.

There may be a requirement to relocate the placement of these facilities when highway needs so require, and at the expense of the franchise holder.

There are two types of franchises:

- (A) Those that require approval of Caltrans.
- (B) Those that do not require approval by Caltrans.

Written approval by Caltrans is required prior to a franchise being approved by a city or county when:

- (A) The location of the franchise encumbers controlled access right of way (freeways and expressways).
- (B) It is intended for the placement of street or railroad tracks, or the operations of street railroads or other railroads on any State highway. Caltrans is required to approve or reject a request for approval within 90 days after the application is filed with Caltrans. Failure of the Department to act upon any such application shall be deemed to constitute approval thereof.

An exception is that a franchise may be granted over the common area of an intersection without written approval from Caltrans.

The city or county shall give notice to Caltrans of its intention to grant any franchise, at the time of filing of such application by any applicant. (See Streets and Highways Code 688).

**Y.06.11      Commercial Use of Right of Way**

State highway right of way may not be used for commercial purposes. Construction of road approaches to allow access to and from commercial property adjacent to highway right of way, and the installation of public utilities or other public service facilities, are only allowed within highway right of way under an encroachment permit, when not restricted by access controlled right of way (freeways and expressways).

Service stations and other roadside vending establishments shall be set back on private property to allow sufficient width for service driveways outside of the right of way. The servicing of vehicles within the limits of the State highway right of way is not allowed.

The construction of driveway approaches to service stations will not be allowed unless a clear minimum distance of at least 10 feet is provided between the gasoline pump block and the property line.

Vending within highway right of way from any vehicle or structure is prohibited under Section 731, of the Streets and Highways Code. Assistance of the California Highway Patrol or local law enforcement should be requested in persistent cases.

Storage tanks, loading platforms, private truck scales, etc., are not allowed within highway right of way.

Permits may be granted to public transportation agencies to construct or place bus passenger waiting shelters within a conventional highway.

#### **Y.06.12      Procedure on Unauthorized Encroachment**

When a private party is working within State highway right of way, and they do not have an encroachment permit in their possession, or did not apply for and obtain an encroachment permit, this constitutes an illegal encroachment.

When this type of situation arises, the following procedures shall be followed:

- (A) Approach the party doing the work in a friendly manner;
- (B) Ask if they have obtained an encroachment permit to do this work;
- (C) If they have not, then explain to them the requirements for doing work within State highway right of way;
- (D) Contact the permit inspector for that area and inform them of the illegal encroachment;
- (E) If the work being done can be deemed minor in character, and imposes no threat or safety impact to the traveling public, the work may be allowed to continue, if:
  - (1) The work will not affect the condition of the highway;
  - (2) The party doing the work is willing to follow the requirements stipulated by the Maintenance Area Superintendent or Maintenance Supervisor; and
  - (3) The party fills out an application for an encroachment permit.

- (F) If the work being done does or will affect the roadway, safety of traffic, appearance or future development of the highway, then the following procedures shall be followed:
- (1) Contact the Permit Inspector for that area;
  - (2) Request the party to stop all work, and explain why;
  - (3) Notify the party that you may have to contact local law enforcement or CHP if warranted (the party refuses to stop work);
  - (4) Tag the work site as an illegal encroachment (red tag);
  - (5) Provide a copy of the tag to the party working;
  - (6) Notify the Maintenance Area Superintendent and District Permits Office.

The Deputy District Director, Maintenance may consider the advisability of initiating civil action to collect costs, to remove, enjoin, or otherwise resolve the situation. Field forces will not take removal action under an encroachment notice without specific instructions by district Maintenance.

However, Maintenance forces may summarily remove encroachments within the right of way which consists of refuse or is an advertising sign (except legal notices). (See S&HC Section 721 and Chapter “D1” of this manual for more details).

### **SECTION 3: TRANSPORTATION PERMITS**

#### **Y.07 Transportation Permits**

##### **Y.07.1 Statutory Authority**

Division 15, of the California Vehicle Code, contains statutory limitation on size, weight, and loading of vehicles. Section 35780 grants discretionary authority to Caltrans to issue special permits in writing upon written application to exceed these limitations on State highways when good cause appears. This authority is delegated to Caltrans and is administered by the Office of Truck Services Transportation Permits Branch of the Division of Traffic Operations. It is unlawful to operate or move any non-exempt vehicle or load exceeding legal limitations or duly posted weight limits without a special permit referred to as a transportation permit.

Section 35795, of the California Vehicle Code, provides that the Department of Transportation may charge a fee for the issuance of transportation permits. The fee schedule shall produce estimated revenue not to exceed the total cost to the Department for administering the issuance of transportation permits.

##### **Y.07.2 Transportation Permit Manual**

The “Transportation Permits Manual” provides detailed information on the transportation permit process. Information is provided regarding submittal of the application, obtaining and the issuance of transportation permits. Departmental Policy Memos and other resources can be researched at the following web site: <http://www.dot.ca.gov/hq/traffops/permits/>.

##### **Y.07.3 Transportation Permit Offices**

There are two Regional Transportation Permit Offices, the Northern Regional Office is located in Sacramento and has jurisdiction over all trips originating west of Mono and Inyo Counties, and North of Kern and San Luis Obispo Counties. The Southern Regional Office supports all other Counties and is located in San Bernardino. The Regional Office locations and other contact information can also be found at the web site mentioned above.

Permit applications may be submitted, by the applicant or someone acting on their behalf, electronically, by fax, mail or over the counter. Permits may be issued to the applicant or someone acting on their behalf, electronically, by fax, mail or over the counter.

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**Y.07.4          Extra-legal Weight Charts**

The Office of Structures Maintenance has analyzed and assigned capacity ratings to all bridges on the State highway system. The assigned rating controls the amount of extra-legal weight that may cross the given structure. The various routes are classified as capable of carrying no permit load or multiple axles, orange, green or purple straight or bonus weight. This information is recorded on Caltrans' "Route Clearing Database." The database and extra-legal weight charts can also be found at the above web site.

**Y.07.5          Procedure on Control of Illegal Loads**

When any of the following occurs, Department personnel shall immediately notify the local Highway Patrol, with all available information (company name, tag numbers, etc.):

- (A) An extralegal/weight load is observed moving over a State highway without a transportation permit;
- (B) An extralegal/weight load is not moving in accordance with the terms and conditions of a transportation permit;
- (C) An extralegal/weight load has been involved in an incident such as a bridge hit or accident (also notify the local District Traffic Manager and Transportation Permit Regional Office of all incidents as well);
- (D) A report is received regarding an extra-legal load and/or vehicle traveling without a transportation permit, not moving in accordance with the terms and conditions of a transportation permit or has been involved in an incident such as a bridge hit or accident (report all incidents to the local District Traffic Manager and Transportation Permit Regional Office as well).

A detailed record shall be kept of damage to highway facilities by extra-legal loads and/or vehicles so that action may be taken to collect cost of repairs from the responsible party and other purposes. Information on all incidents (bridge hits, accidents, etc.) should be forwarded to the California Highway Patrol as well as the local District Traffic Manager and Regional Transportation Permit Regional Office in whose jurisdiction the incident occurred (this is for compliance, statistical and other reasons).

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**Section 01     Definitions of Terms**

<b>Abrasion</b>	Wearing away by friction.
<b>Admixture</b>	That which is added and mixed. For example: Calcium or sodium chloride, clay, sand, etc., added to a gravel road surface.
<b>Aggregate</b>	Road materials composed of mineral substances, such as gravel, crushed stone, slag, sand, or combinations of these, used for various purposes in highway maintenance and construction.
<b>Asphalt</b>	A brown to black solid bituminous substance, soluble in gasoline or naphtha.
<b>Backfill</b>	Material used in filling an excavation or the act of filling an excavation.
<b>Base Course</b>	The supporting layer immediately under the surfacing.
<b>Basement Soil</b>	The material in excavations, embankments and embankment foundations immediately below the first layer of subbase, base, or pavement, and to such depth as may affect structural design.
<b>Binder</b>	Material used to stabilize or cement together loose soil or aggregates.
<b>Bitumen</b>	Any of several flammable hydrocarbon substances, which may be liquid, semisolid, or solid. For road maintenance work, bitumen commonly means any of several road oils, either asphalt or tar, covered by various specifications.
<b>Bituminous Pavement</b>	A pavement composed of crushed rock or other aggregate cemented together with bitumen.
<b>Blading</b>	Planing or smoothing the surface of various parts of the roadway by means of a motor driven adjustable steel blade.
<b>Bleeding</b>	The exuding of excess bituminous material on the roadway surface, caused by heat or the use of excessive quantities of bituminous material in construction, patching or resurfacing.
<b>Borrow Pit</b>	A location where fill or base material may be, or has been, excavated. No borrow pits shall be constructed within 500 feet of the center line of a highway right of way.

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<b>Bridge</b>	Structures of a span of more than 20 feet, measured under the copings along the centerline of the road and multiple span structures where the individual spans are in excess of 10 feet, from center to center of supports along the centerline of the road.
<b>Bulking</b>	Swelling, separation of particles and increased volume of aggregate due to the presence of a small percentage of moisture.
<b>Camber</b>	To cause to arch slightly, or curve upward toward the center, as the middle of a bridge or culvert.
<b>Check Dam</b>	A structure, usually made of timbers, stone or concrete placed in a watercourse to retard the flow of water, thereby reducing erosion. Check dams may be used singly or in series.
<b>Checking or Alligatoring</b>	Myriad cracks or checks in bituminous surfaces extending over areas of variable proportions and resulting from a yielding of wet subgrade or from the drying out of the surface.
<b>Cold Patch</b>	A mixture of bituminous material and aggregate used for general maintenance pavement patching and applied at normal temperatures.
<b>Concrete, Bituminous</b>	A mixture of bitumen and mineral aggregate used as a wearing surface. Placed either hot or cold.
<b>Concrete, Portland Cement</b>	A mixture usually composed of portland cement, an aggregate of hard, inert particles and water.
<b>Consistency</b>	The degree of cohesion of particles. Some of the terms used to express consistency are; Firm, hard, pliable, sticky, soft.
<b>Course</b>	A layer of road material, separately compacted, used as a wearing surface or as a base for a wearing surface.
<b>Creosote</b>	An oily liquid, used in wood preservation, colorless when pure but usually colored yellow or brown by impurity or exposure.
<b>Crown</b>	A measure of the elevation of the center of the road in relation to the outside edges of the road surface.
<b>Culvert</b>	All waterway structures not defined as bridges.
<b>Cutback</b>	Bituminous material mixed with light, volatile oil to reduce viscosity and increase workability.

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<b>Cut Section</b>	That part of the roadway which when constructed, is lower in elevation than the original ground.
<b>Deadman</b>	A buried object, serving as an anchor, such as cable guard rail guy anchors.
<b>Deciduous</b>	Having leaves which are shed at the end of the growing season; opposed to evergreen.
<b>Density</b>	1) The degree of consolidation or compactness. 2) The ratio of weight to volume of a substance.
<b>Dust Palliative</b>	1) Any chemical, in flake form or in solution, used to control dust. 2) Liquid asphaltic oil.
<b>Expressway</b>	A divided arterial highway for through traffic with full or partial control of access.
<b>Flash Point</b>	That particular temperature at which a material gives off flammable vapor in sufficient quantity to burn instantaneously at the approach of a flame or spark.
<b>Freeway</b>	An expressway with full control of access and all grade crossings eliminated.
<b>Grout</b>	Mortar composed of sand, cement, and water, of such consistency that it can be worked easily.
<b>Hydrophilic</b>	A term spoken of an aggregate having a greater affinity for mixing with water than with oil.
<b>Impervious</b>	A bed or stratum of material through which water will not move under ordinary hydrostatic pressure.
<b>Miscibility</b>	Ability of a substance to be mixed.
<b>Mudsills</b>	Logs or timber placed in a horizontal position on the ground or in a stream bed to support timber bents built up with vertical and diagonal members.
<b>Noxious</b>	Injurious, destructive, objectionable, as noxious weeds or odors.
<b>Outcrop</b>	The cropping out of a rock stratum, exposed at or near the surface of the ground.
<b>Pervious</b>	A bed or stratum of material through which water will move under ordinary hydrostatic pressure.
<b>Pigment</b>	Any substance used to impart color; specifically, an insoluble, dry coloring matter which, when mixed with suitable medium, forms paint.

<b>Plasticity Index</b>	The range of moisture content through which the soil material is plastic, expressed as the difference between the liquid limit and the plastic limit, which are expressed as a percentage of the weight of the completely dried soil material.
<b>Portland Cement</b>	A hydraulic cement consisting of compounds of silica, lime and alumina, so called from its resemblance in color, when set, to the portland stone of England.
<b>Pot Hole</b>	A pit or hole extending into the wearing surface.
<b>Premix</b>	1) To mix, in a central mixing plant or elsewhere, previous to placing. 2) Any prepared bituminous patching or surfacing material that can be applied either hot or cold.
<b>Prime Coat</b>	A bituminous application to seal, bind together and waterproof the top portion of a gravel or crushed aggregate base subsequent to the placing of a surface course.
<b>Profile</b>	A longitudinal section of a highway, drainage course, etc.
<b>Quartering</b>	Dividing into four equal parts, so that each part is truly representative of the whole. Applied generally in obtaining representative samples.
<b>Raveling</b>	The progressive loosening of the material in the surface course of a road.
<b>Retread</b>	A surface composed of bituminous materials and aggregate placed on an existing surface.
<b>Road Material</b>	Any road material, such as concrete, gravel, crushed stone, slag, etc., which is used for a wearing surface.
<b>Serrated</b>	Having teeth or scalloped edges.
<b>Shoe, Bridge</b>	A bridge corner support.
<b>Skew</b>	Oblique, not at right angles.
<b>Slip</b>	Section of roadway fill which slips out or moves down below its normal elevation.
<b>Spalling</b>	Chipping along the edges, as at joints in concrete pavements and structures.
<b>Specific Gravity</b>	The ratio of the weight of any volume of a substance to the weight of an equal volume of water at 4 degrees Centigrade taken as a standard.

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<b>Stabilize</b>	To bind aggregates, etc., together by adding and thoroughly mixing the proper amount of clay or other binding materials, also to increase bearing power of clay, soil, etc., by mixing sand or aggregate, as in shoulder stabilization.
<b>Station</b>	A standard of length, usually 100 feet, measured along the center line of a road or along a survey line.
<b>Subbase</b>	An auxiliary course to furnish needed stability, usually due to poor subgrade.
<b>Subgrade</b>	That portion of the roadbed on which pavement, surfacing, base, subbase, or a layer of any other material which may be specified, is to be placed.
<b>Subsoil</b>	The bed of earth immediately below the surface soil.
<b>Tack Coat</b>	A coat of bituminous material applied to a surface to prepare the latter for subsequent applications of aggregate and bituminous materials.
<b>Talus</b>	The accumulation of debris at the base of a cliff or slope chiefly as the result of gravitational roll or slide.
<b>Vehicle</b>	<ol style="list-style-type: none"><li>1) The liquid portion of paint.</li><li>2) Every device by which any person or property is transported or drawn upon a public highway, excepting devices used exclusively upon stationary rails or tracks.</li></ol>
<b>Viscosity</b>	The resistance of a fluid to flow.
<b>Voids</b>	The empty spaces between particles in a substance or mixture.
<b>Volatile</b>	Evaporating readily.
<b>Waterbound</b>	Bonded with the aid of water.
<b>Xylene Equivalent</b>	The test to determine whether an asphalt has been cracked or injured by overheating during the refining process.

## **Section 02 Volume-Temperature Correction of Asphaltic Products**

The temperature of 60° F is taken as the standard for volume measurement of asphaltic products. If the volume is actually measured at any temperature other than 60° F a correction factor must be applied. As volume-temperature relations vary somewhat with specific gravity, it is necessary that the connection factor be selected from the proper table group. The tables of reduction factors given herewith are intended for use in reducing oil volumes to the basis of 60° F when extreme accuracy is not required.

### **Section 02.01 Conversion Table I**

The following table is to be used for converting volumes of liquid asphalt products, grades 250 to 3000 inclusive, and paving asphalts, grades AR-1000 to AR-16000 inclusive.

Legend:

- t      observed temperature in degrees Fahrenheit.
- M      multiplier for reducing volumes to the basis of 60° F.

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t	M	t	M	t	M	t	M	t	M	t	M
0	1.0211	35	1.0088	70	0.9965	105	0.9844	140	0.9723	175	0.9604
1	1.0208	36	1.0084	71	0.9962	106	0.9840	141	0.9720	176	0.9601
2	1.0204	37	1.0081	72	0.9958	107	0.9837	142	0.9716	177	0.9597
3	1.0201	38	1.0077	73	0.9955	108	0.9833	143	0.9713	178	0.9594
4	1.0197	39	1.0074	74	0.9951	109	0.9830	144	0.9710	179	0.9590
5	1.0194	40	1.0070	75	0.9948	110	0.9826	145	0.9706	180	0.9587
6	1.0190	41	1.0067	76	0.9944	111	0.9823	146	0.9703	181	0.9584
7	1.0186	42	1.0063	77	0.9941	112	0.9819	147	0.9699	182	0.9580
8	1.0183	43	1.0060	78	0.9937	113	0.9816	148	0.9696	183	0.9577
9	1.0179	44	1.0056	79	0.9934	114	0.9813	149	0.9693	184	0.9574
10	1.0176	45	1.0053	80	0.9930	115	0.9809	150	0.9689	185	0.9570
11	1.0172	46	1.0049	81	0.9927	116	0.9806	151	0.9686	186	0.9567
12	1.0169	47	1.0046	82	0.9923	117	0.9802	152	0.9682	187	0.9563
13	1.0165	48	1.0042	83	0.9920	118	0.9799	153	0.9679	188	0.9560
14	1.0162	49	1.0038	84	0.9916	119	0.9795	154	0.9675	189	0.9557
15	1.0158	50	1.0035	85	0.9913	120	0.9792	155	0.9672	190	0.9553
16	1.0155	51	1.0031	86	0.9909	121	0.9788	156	0.9669	191	0.9550
17	1.0151	52	1.0028	87	0.9906	122	0.9785	157	0.9665	192	0.9547
18	1.0148	53	1.0024	88	0.9902	123	0.9782	158	0.9662	193	0.9543
19	1.0144	54	1.0021	89	0.9899	124	0.9778	159	0.9658	194	0.9540
20	1.0141	55	1.0017	90	0.9896	125	0.9775	160	0.9655	195	0.9536
21	1.0137	56	1.0014	91	0.9892	126	0.9771	161	0.9652	196	0.9533
22	1.0133	57	1.0010	92	0.9889	127	0.9768	162	0.9648	197	0.9530
23	1.0130	58	1.0007	93	0.9885	128	0.9764	163	0.9645	198	0.9526
24	1.0126	59	1.0003	94	0.9882	129	0.9761	164	0.9641	199	0.9523
25	1.0123	60	1.0000	95	0.9878	130	0.9758	165	0.9638	200	0.9520
26	1.0119	61	0.9997	96	0.9875	131	0.9754	166	0.9635	201	0.9516
27	1.0116	62	0.9993	97	0.9871	132	0.9751	167	0.9631	202	0.9513
28	1.0112	63	0.9990	98	0.9868	133	0.9747	168	0.9628	203	0.9509
29	1.0109	64	0.9986	99	0.9864	134	0.9744	169	0.9624	204	0.9505
30	1.0105	65	0.9983	100	0.9861	135	0.9740	170	0.9621	205	0.9503
31	1.0102	66	0.9979	101	0.9857	136	0.9737	171	0.9618	206	0.9499
32	1.0098	67	0.9976	102	0.9854	137	0.9734	172	0.9614	207	0.9496
33	1.0095	68	0.9972	103	0.9851	138	0.9730	173	0.9611	208	0.9493
34	1.0091	69	0.9969	104	0.9847	139	0.9727	174	0.9607	209	0.9489

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**Conversion Table I-Continued**

t	M	t	M	t	M	t	M	t	M	t	M
210	0.9486	250	0.9352	290	0.9220	330	0.9089	370	0.8960	410	0.8832
211	0.9483	251	0.9349	291	0.9217	331	0.9086	371	0.8957	411	0.8829
212	0.9479	252	0.9346	292	0.9213	332	0.9083	372	0.8953	412	0.8826
213	0.9476	253	0.9342	293	0.9210	333	0.9079	373	0.8950	413	0.8822
214	0.9472	254	0.9339	294	0.9207	334	0.9076	374	0.8947	414	0.8819
215	0.9469	255	0.9336	295	0.9204	335	0.9073	375	0.8944	415	0.8816
216	0.9466	256	0.9332	296	0.9200	336	0.9070	376	0.8941	416	0.8813
217	0.9462	257	0.9329	297	0.9197	337	0.9066	377	0.8937	417	0.8810
218	0.9459	258	0.9326	298	0.9194	338	0.9063	378	0.8934	418	0.8806
219	0.9456	259	0.9322	299	0.9190	339	0.9060	379	0.8931	419	0.8803
220	0.9452	260	0.9319	300	0.9187	340	0.9057	380	0.8928	420	0.8800
221	0.9449	261	0.9316	301	0.9184	341	0.9053	381	0.8924	421	0.8797
222	0.9446	262	0.9312	302	0.9181	342	0.9050	382	0.8921	422	0.8794
223	0.9442	263	0.9309	303	0.9177	343	0.9047	383	0.8918	423	0.8791
224	0.9439	264	0.9306	304	0.9174	344	0.9044	384	0.8915	424	0.8989
225	0.9436	265	0.9302	305	0.9171	345	0.9040	385	0.8912	425	0.8984
226	0.9432	266	0.9299	306	0.9167	346	0.9037	386	0.8908	426	0.8781
227	0.9429	267	0.9296	307	0.9164	347	0.9034	387	0.8905	427	0.8778
228	0.9426	268	0.9293	308	0.9161	348	0.9031	388	0.8902	428	0.8775
229	0.9422	269	0.9289	309	0.9158	349	0.9028	389	0.8899	429	0.8772
230	0.9419	270	0.9286	310	0.9154	350	0.9024	390	0.8896	430	0.8768
231	0.9416	271	0.9283	311	0.9151	351	0.9021	391	0.8892	431	0.8765
232	0.9412	272	0.9279	312	0.9148	352	0.9018	392	0.8889	432	0.8762
233	0.9409	273	0.9276	313	0.9145	353	0.9015	393	0.8886	433	0.8759
234	0.9405	274	0.9273	314	0.9141	354	0.9011	394	0.8883	434	0.8756
235	0.9402	275	0.9269	315	0.9138	355	0.9008	395	0.8880	435	0.8753
236	0.9399	276	0.9266	316	0.9135	356	0.9005	396	0.8876	436	0.8749
237	0.9395	277	0.9263	317	0.9132	357	0.9002	397	0.8873	437	0.8746
238	0.9392	278	0.9259	318	0.9128	358	0.8998	398	0.8870	438	0.8743
239	0.9389	279	0.9256	319	0.9125	359	0.8995	399	0.8867	439	0.8740
240	0.9385	280	0.9253	320	0.9122	360	0.8992	400	0.8864	440	0.8737
241	0.9382	281	0.9250	321	0.9118	361	0.8989	401	0.8861	441	0.8734
242	0.9379	282	0.9246	322	0.9115	362	0.8986	402	0.8857	442	0.8731
243	0.9375	283	0.9243	323	0.9112	363	0.8982	403	0.8854	443	0.8727
244	0.9372	284	0.9240	324	0.9109	364	0.8979	404	0.8851	444	0.8724
245	0.9369	285	0.9236	325	0.9105	365	0.8976	405	0.8848	445	0.8721
246	0.9365	286	0.9233	326	0.9102	366	0.8973	406	0.8845	446	0.8718
247	0.9362	287	0.9230	327	0.9099	367	0.8969	407	0.8841	447	0.8715
248	0.9359	288	0.9227	328	0.9096	368	0.8966	408	0.8838	448	0.8712
249	0.9356	289	0.9223	329	0.9092	369	0.8963	409	0.8835	449	0.8709

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**Conversion Table I-Continued**

450	0.8705	460	0.8674	470	0.8643	480	0.8611	490	0.8580
451	0.8702	461	0.8671	471	0.8640	481	0.8608	491	0.8577
452	0.8699	462	0.8668	472	0.8636	482	0.8605	492	0.8574
453	0.8696	463	0.8665	473	0.8633	483	0.8602	493	0.8571
454	0.8693	464	0.8661	474	0.8630	484	0.8599	494	0.8568
455	0.8690	465	0.8658	475	0.8627	485	0.8596	495	0.8565
456	0.8687	466	0.8655	476	0.8624	486	0.8593	496	0.8562
457	0.8683	467	0.8652	477	0.8621	487	0.8590	497	0.8559
458	0.8680	468	0.8649	478	0.8618	488	0.8587	498	0.8556
459	0.8677	469	0.8646	479	0.8615	489	0.8583	499	0.8552

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## Section 02.02 Conversion Table II

The following table is to be used for converting volumes of liquid asphalt product, grade 70.

Legend:

- t observed temperature in degrees Fahrenheit.
- M multiplier for reducing volumes to the basis of 60° F.

t	M	t	M	t	M	t	M	t	M	t	M
0	1.0241	35	1.0100	70	0.9960	105	0.9822	140	0.9686	175	0.9551
1	1.0237	36	1.0096	71	0.9956	106	0.9818	141	0.9682	176	0.9547
2	1.0233	37	1.0092	72	0.9952	107	0.9814	142	0.9678	177	0.9543
3	1.0229	38	1.0088	73	0.9948	108	0.9810	143	0.9674	178	0.9539
4	1.0225	39	1.0084	74	0.9944	109	0.9806	144	0.9670	179	0.9536
5	1.0221	40	1.0080	75	0.9940	110	0.9803	145	0.9666	180	0.9532
6	1.0217	41	1.0076	76	0.9936	111	0.9799	146	0.9662	181	0.9528
7	1.0213	42	1.0072	77	0.9932	112	0.9795	147	0.9659	182	0.9524
8	1.0209	43	1.0068	78	0.9929	113	0.9791	148	0.9655	183	0.9520
9	1.0205	44	1.0064	79	0.9925	114	0.9787	149	0.9651	184	0.9517
10	1.0201	45	1.0060	80	0.9921	115	0.9783	150	0.9647	185	0.9513
11	1.0197	46	1.0056	81	0.9917	116	0.9779	151	0.9643	186	0.9509
12	1.0193	47	1.0052	82	0.9913	117	0.9775	152	0.9639	187	0.9505
13	1.0189	48	1.0048	83	0.9909	118	0.9771	153	0.9635	188	0.9501
14	1.0185	49	1.0044	84	0.9905	119	0.9767	154	0.9632	189	0.9498
15	1.0181	50	1.0040	85	0.9901	120	0.9763	155	0.9628	190	0.9494
16	1.0177	51	1.0036	86	0.9897	121	0.9760	156	0.9624	191	0.9490
17	1.0173	52	1.0032	87	0.9893	122	0.9756	157	0.9620	192	0.9486
18	1.0168	53	1.0028	88	0.9889	123	0.9752	158	0.9616	193	0.9482
19	1.0164	54	1.0024	89	0.9885	124	0.9748	159	0.9612	194	0.9478
20	1.0160	55	1.0020	90	0.9881	125	0.9744	160	0.9609	195	0.9475
21	1.0156	56	1.0016	91	0.9877	126	0.9740	161	0.9605	196	0.9471
22	1.0152	57	1.0012	92	0.9873	127	0.9736	162	0.9601	197	0.9467
23	1.0148	58	1.0008	93	0.9869	128	0.9732	163	0.9597	198	0.9463
24	1.0144	59	1.0004	94	0.9865	129	0.9728	164	0.9593	199	0.9460
25	1.0140	60	1.0000	95	0.9861	130	0.9725	165	0.9589	200	0.9456
26	1.0136	61	0.9996	96	0.9857	131	0.9721	166	0.9585	201	0.9452
27	1.0132	62	0.9992	97	0.9854	132	0.9717	167	0.9582	202	0.9448
28	1.0128	63	0.9988	98	0.9850	133	0.9713	168	0.9578	203	0.9444
29	1.0124	64	0.9984	99	0.9846	134	0.9709	169	0.9574	204	0.9441
30	1.0120	65	0.9980	100	0.9842	135	0.9705	170	0.9570	205	0.9437
31	1.0116	66	0.9976	101	0.9838	136	0.9701	171	0.9566	206	0.9433
32	1.0112	67	0.9972	102	0.9834	137	0.9697	172	0.9562	207	0.9429
33	1.0108	68	0.9968	103	0.9830	138	0.9693	173	0.9559	208	0.9425
34	1.0104	69	0.9964	104	0.9826	139	0.9690	174	0.9555	209	0.9422

**Conversion Table II-Continued**

210	0.9418	220	0.9380	230	0.9343	240	0.9305
211	0.9414	221	0.9376	231	0.9339	241	0.9301
212	0.9410	222	0.9373	232	0.9335	242	0.9298
213	0.9407	223	0.9369	233	0.9331	243	0.9294
214	0.9403	224	0.9365	234	0.9328	244	0.9290
215	0.9399	225	0.9361	235	0.9324	245	0.9286
216	0.9395	226	0.9358	236	0.9320	246	0.9283
217	0.9391	227	0.9354	237	0.9316	247	0.9279
218	0.9388	228	0.9350	238	0.9313	248	0.9275
219	0.9384	229	0.9346	239	0.9309	249	0.9272

**Section 02.03 Conversion Table III**

The following table is to be used for converting volumes of all types of asphaltic emulsion specified in this section.

Legend:

- t      observed temperature in degrees Fahrenheit.  
M      multiplier for reducing volumes to the basis of 60° F.

t	M	t	M	t	M	t	M	t	M
60	1.00000	78	.99550	96	.99100	115	.98625	133	.98175
61	.99975	79	.99525	97	.99075	116	.98600	134	.98150
62	.99950	80	.99500	98	.99050	117	.98575	135	.98125
63	.99925	81	.99475	99	.99025	118	.98550	136	.98100
64	.99900	82	.99450	100	.99000	119	.98525	137	.98075
65	.99875	83	.99425	101	.98975	120	.98500	138	.98050
66	.99850	84	.99400	102	.98950	121	.98475	139	.98025
67	.99825	85	.99375	103	.98925	122	.98450	140	.98000
68	.99800	86	.99350	104	.98900	123	.98425	141	.97975
69	.99775	87	.99325	105	.98875	124	.98400	142	.97950
70	.99750	88	.99300	106	.98850	125	.98375	143	.97925
71	.99725	89	.99275	107	.98825	126	.98350	144	.97900
72	.99700	90	.99250	108	.98800	127	.98325	145	.97875
73	.99675	91	.99225	109	.98775	128	.98300	146	.97850
74	.99650	92	.99200	110	.98750	129	.98275	147	.97825
75	.99625	93	.99175	111	.98725	130	.98250	148	.97800
76	.99600	94	.99150	112	.98700	131	.98225	149	.97775
77	.99575	95	.99125	113	.98675	132	.98200	150	.97750
				114	.98650				

**Section 03      Application Temperature of Liquid Asphalts**

Grade of Liquid Asphalt	Pug Mill Mixing Temperature of Aggregate Maximum °F.	Distributor Application Temperature	
		Minimum °F.	Maximum °F.
SC-70.....	.....	105	175
SC-250.....	200	140	225
SC-800.....	225	175	255
SC-3000.....	260	215	290
MC-70.....	.....	105	175
MC-250.....	200	140	225
MC-800.....	225	175	255
MC-3000.....	260	215	290
RC-70.....	.....	105	175
RC-250.....	.....	140	225
RC-800.....	.....	175	255
RC-3000.....	.....	215	290
ROMC-3.....	200	175	255

## **Section 04    Weights and Volumes of Asphaltic Road Materials**

Volumetric measurements of liquid asphalt at any temperature shall be reduced to the volume the material would occupy a 60° F before converting the volumetric measurements to weight. The following tables shall be used to convert the volumes from gallons to weight.

All types SC, MC, ROMC and RC, of the same grade shall be considered to have equal weights per volume.

**Average Weights and Volumes of Liquid Asphalt**

Grade	Gallons per Ton at 60°F.	Barrels per Ton at 60°F. (42 U.S. Gals.)	Pounds per Gal. at 60°F.
.....	253	6.03	7.90
.....	249	5.93	8.03
.....	245	5.83	8.16
.....	241	5.74	8.30
3.....	245	5.83	8.16

**Average Weights and Volumes of Paving Asphalt**

Grade	Gallons per Ton at 60°F.	Barrels per Ton at 60°F. (42 U.S. Gals.)	Pounds per Gal. at 60°F.
AR-1000.....	239	5.70	8.36
AR-2000.....	237	5.64	8.44
AR-4000.....	235	5.60	8.51
AR-8000.....	235	5.60	8.51
AR-16000.....	235	5.60	8.51

**Average Weights and Volumes of Asphaltic Emulsion**

Type of Emulsion	Gallons per Ton at 60°F.	Barrels per Ton at 60°F. (42 U.S. Gals.)	Pounds per Gal. at 60°F.
Penetration.....	240	5.71	8.33
Mixing.....	240	5.71	8.33
High Viscosity....	240	5.71	8.33

Refer to Standard Specifications for additional data on liquid asphalts and asphaltic emulsions.

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**Application Temperatures - Degrees F**

	<b>TYPE</b>	<b>MIN TEMP</b>	<b>MAX TEMP</b>
<b>Emulsified Asphalt</b>	Penetration	75	130
<b>Emulsified Asphalt</b>	Mixing	75	130
<b>Paving Asphalts</b>	all grades	250	375

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## Section 05 Liquid Asphalt Tons per Mile

Width	1/4 gallon application, tons per mile				1/2 gallon application, tons per mile				1 gallon application, tons per mile			
	SC-70	SC-250	SC-800	Emul.	SC-70	SC-250	SC-800	Emul.	SC-70	SC-250	SC-800	Emul.
2.0.....	1.1594	1.1780	1.1973	1.2222	2.3188	2.3561	2.3946	2.4444	4.6377	4.7122	4.7891	4.8889
3.5.....	2.0290	2.0616	2.0952	2.1389	4.0580	4.1232	4.1905	4.2778	8.1159	8.2463	8.3810	8.5556
4.0.....	2.3188	2.3561	2.3946	2.4444	4.6277	4.7122	4.7891	4.8889	9.2754	9.4244	9.5782	9.7778
5.0.....	2.8986	2.9451	2.9932	3.0556	5.7971	5.8902	5.9864	6.1111	11.5942	11.7904	11.9728	12.2222
6.0.....	3.4783	3.5341	3.5918	3.6667	6.9565	7.0683	7.1837	7.3333	13.9130	14.1365	14.3673	14.6667
7.0.....	4.0580	4.1232	4.1905	4.2778	8.1159	8.2463	8.3810	8.5556	16.2319	16.4926	16.7619	17.1111
8.0.....	4.6377	4.7122	4.7891	4.8889	9.2754	9.4244	9.5782	9.7778	18.5507	18.8487	19.1565	19.5556
9.0.....	5.2174	5.3012	5.3878	5.5000	10.4348	10.6024	10.7755	11.0000	20.8696	21.2048	21.5510	22.0000
10.0.....	5.7971	5.8902	5.9864	6.1111	11.5942	11.7804	11.9728	12.2222	23.1884	23.5609	23.9456	24.4444
11.0.....	6.3768	6.4792	6.5850	6.7222	12.7536	12.9585	13.1701	13.4444	25.5072	25.9170	26.3401	26.8889
12.0.....	6.9565	7.0683	7.1837	7.3333	13.9130	14.1365	14.3673	14.6667	27.8261	28.2731	28.7347	29.3333
13.0.....	7.5362	7.6573	7.7823	7.9444	15.0725	15.3146	15.5646	15.8889	30.1449	30.6292	31.1292	31.7778
14.0.....	8.1159	8.2463	8.3810	8.5556	16.2319	16.4926	16.7619	17.1111	32.4638	32.9853	33.5238	34.2222
15.0.....	8.6956	8.8353	8.9796	9.1667	17.3913	17.6707	17.9592	18.3333	34.7826	35.3414	35.9184	36.6667
16.0.....	9.2754	9.4244	9.5782	9.7778	18.5507	18.8487	19.1565	19.5556	37.1014	37.6974	38.3129	39.1111
17.0.....	9.8551	10.0134	10.1769	10.3889	19.7101	20.0268	20.3537	20.7778	39.4203	40.0535	40.7075	41.5555
18.0.....	10.4348	10.6024	10.7755	11.0000	20.8696	21.2048	21.5510	22.0000	41.7391	42.4096	43.1020	44.0000
19.0.....	11.0145	11.1914	11.3741	11.6111	22.0290	22.3829	22.7483	23.2222	44.0580	44.7657	45.4966	46.4444
20.0.....	11.5942	11.7804	11.9728	12.2222	23.1884	23.5609	23.9456	24.4444	46.3768	47.1218	47.8912	48.8889

Quantities used--SC-70--253 gallons per ton  
SC-250--249 gallons per ton  
SC-800--245 gallons per ton  
Emulsion--240 gallons per ton

Example--One-fifth gallon SC-800 to be applied 20 feet wide for 2.2 miles.  
Figure tons and gallons of oil required.

From table--One gallon SC-800--20 feet wide requires 47.89 tons per mile. For 2.2 miles--47.8912 X 2.2 = 105.6306 tons for one-fifth gallon application:

$$\frac{105.6306}{5} = 21.07 \text{ tons}$$

or 21.07 X 245 = 5162.15 gallons required

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**Section 06     Area of Pavement Surfaces**

Width in Feet	Square Feet per Mile	Square Yards per Mile	Square Yards per Lineal Foot	Width in Feet	Square Feet per Mile	Square Yards per Mile	Square Yards per Lineal Foot
1.....	5,280	587	0.1111	18.....	95,040	10,560	2.0000
8.....	42,240	4,693	0.8889	20.....	105,600	11,733	2.2222
9.....	47,520	5,280	1.0000	22.....	116,160	12,907	2.4444
10.....	52,800	5,867	1.1111	24.....	126,720	14,080	2.6667
11.....	58,080	6,453	1.2222	26.....	137,280	15,253	2.8889
12.....	63,360	7,040	1.3333	28.....	147,840	16,427	3.1111
15.....	79,200	8,800	1.6667	30.....	158,400	17,600	3.3333
16.....	84,480	9,387	1.7778				

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## Section 07    Tons Asphalt per Mile of Paving

Based on 240 Gals. /Ton, 5 Percent Asphalt by Wt. and 111.15 # Mix Per Sq. Yd.

Width in feet	Square yards per mile	Tons per mile	Tons asphalt per mile				
		1.0 gal./sq. yd.	1" thick	1 1/2" thick	2" thick	2 1/2" thick	3" thick
1.....	587	2.44	1.63020	2.44530	3.26040	4.07550	4.89060
18.....	10,560	44.00	29.34	44.02	58.69	73.36	88.03
19.....	11,147	46.44	30.97	46.46	61.95	77.43	92.92
20.....	11,733	48.89	32.60	48.91	65.21	81.51	97.81
21.....	12,320	51.33	34.23	51.35	68.47	85.59	102.70
22.....	12,907	53.78	35.86	53.80	71.73	89.66	107.59
23.....	13,493	56.22	37.49	56.24	74.99	93.74	112.48
24.....	14,080	58.67	39.12	58.69	78.25	97.81	117.37
25.....	14,667	61.11	40.76	61.13	81.51	101.89	122.27
26.....	15,253	63.55	42.39	63.58	84.77	105.96	127.16
27.....	15,840	66.00	44.02	66.02	88.03	110.04	132.05
28.....	16,427	68.44	45.65	68.47	91.29	114.11	136.94
29.....	17,013	70.89	47.28	70.91	94.55	118.19	141.83
30.....	17,600	73.33	48.91	73.36	97.81	122.27	146.72

Example: 1 1/2" surfacing is to be placed 22' wide    From table: 53.80 tons asphalt per mile. For 3.2 miles:  
on 3.2 miles. How much asphalt should                      3.2 X 53.80 = 172.160 tons.  
be ordered for the mix?    172 tons X 240 = 41,318 gallons required.

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## Section 08 Emulsions--Gallons per Mile

Rates of application		Width in feet								
Gallons per square yard		8	9	10	12	16	18	20	22	24
$\frac{1}{10}$	0.10.....	469	528	587	704	939	1,056	1,173	1,291	1,408
$\frac{1}{8}$	0.125.....	587	660	733	880	1,173	1,320	1,467	1,613	1,760
$\frac{1}{6}$	0.167.....	782	880	978	1,178	1,564	1,760	1,956	2,151	2,347
$\frac{1}{5}$	0.20.....	939	1,056	1,173	1,408	1,876	2,112	2,347	2,581	2,816
$\frac{1}{4}$	0.25.....	1,173	1,320	1,467	1,760	2,347	2,640	2,933	3,227	3,520
$\frac{1}{3}$	0.333.....	1,564	1,760	1,956	2,347	3,129	3,520	3,911	4,302	4,693
$\frac{1}{2}$	0.50.....	2,347	2,640	2,933	3,520	4,693	5,280	5,867	6,453	7,040
$\frac{2}{3}$	0.667.....	3,129	3,520	3,911	4,693	6,258	7,040	7,822	8,604	9,387
$\frac{3}{4}$	0.75.....	3,520	3,960	4,400	5,280	7,040	7,920	8,800	9,680	10,560
1	1.00.....	4,693	5,280	5,867	7,040	9,387	10,560	11,733	12,907	14,080
1 $\frac{1}{4}$	1.25.....	5,867	6,600	7,333	8,800	11,733	13,200	14,667	16,133	17,600
1 $\frac{1}{2}$	1.50.....	7,040	7,920	8,800	10,560	14,080	15,840	17,600	19,360	21,120
1 $\frac{3}{4}$	1.75.....	8,213	9,240	10,267	12,320	16,427	18,480	20,533	22,587	24,640
2	2.00.....	9,387	10,560	11,733	14,080	18,773	21,120	23,467	25,813	28,160

## Section 09 Volume in C.Y. Pavement per Mile

Depth, inches	Width in feet								
	8	9	10	12	16	18	20	22	24
1.....	130	147	163	196	261	293	326	358	391
2.....	261	293	326	391	521	587	652	717	782
3.....	391	440	489	587	782	880	978	1,076	1,173
4.....	521	587	652	782	1,043	1,173	1,304	1,434	1,564
5.....	652	733	815	978	1,304	1,467	1,630	1,793	1,956
6.....	782	880	978	1,173	1,564	1,760	1,956	2,151	2,347
7.....	913	1,027	1,141	1,369	1,825	2,053	2,281	2,510	2,738
8.....	1,043	1,173	1,304	1,564	2,086	2,347	2,607	2,868	3,129
9.....	1,173	1,320	1,467	1,760	2,347	2,607	2,933	3,227	3,520
10.....	1,304	1,467	1,630	1,956	2,607	2,933	3,259	3,585	3,911
11.....	1,434	1,613	1,793	2,151	2,868	3,227	3,585	3,944	4,302
12.....	1,564	1,760	1,956	2,347	3,129	3,520	3,911	4,302	4,693

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## Section 10 Lineal Feet of Spread for Liquid Asphalt

1.0 Gallon Spread per Square Yard of Finished Road Surface

Gallons of oil	Width of spread, in feet												Gallons of oil
	1	2	3	4	5	6	7	8	9	10	11	12	
	Length of spread, in lineal feet												
5	45	23	15	11	9	8	6	6	5	5	4	4	5
10	90	45	30	23	18	15	13	11	10	9	8	7	10
15	135	68	45	34	27	23	19	17	15	14	12	11	15
20	180	90	60	45	36	30	26	22	20	18	16	15	20
25	225	113	75	56	45	38	32	28	25	23	21	19	25
30	270	135	90	68	54	45	38	34	30	27	25	23	30
35	315	158	105	79	63	53	45	39	35	31	29	26	35
40	360	180	120	90	72	60	51	45	40	36	33	30	40
45	405	203	135	101	81	68	58	50	45	40	37	34	45
50	450	225	150	113	90	75	64	56	50	45	41	38	50
55	495	248	165	124	99	83	70	62	55	50	45	41	55
60	540	270	180	135	108	90	77	67	60	54	49	45	60
65	585	293	195	146	117	98	83	73	65	59	53	49	65
70	630	315	210	158	126	105	90	79	70	63	57	53	70
75	675	338	225	169	130	113	96	84	75	68	62	56	75
80	720	360	240	180	144	120	102	90	80	72	66	60	80
85	765	383	255	191	153	127	109	95	85	77	70	64	85
90	810	405	270	203	162	135	115	101	90	81	74	68	90
95	855	428	285	214	171	143	122	107	95	85	78	71	95
100	900	450	300	225	180	150	128	112	100	90	82	75	100
200	1,800	900	600	450	360	300	256	225	200	180	164	150	200
300	2,700	1,350	900	675	540	450	386	338	300	270	246	225	300
400	3,600	1,800	1,200	900	720	600	514	450	400	360	327	300	400
500	4,500	2,250	1,500	1,125	900	750	643	563	500	450	409	375	500
600	5,400	2,700	1,800	1,350	1,080	900	772	675	600	540	491	450	600
700	6,300	3,150	2,100	1,575	1,260	1,050	900	788	700	630	573	525	700
800	7,200	3,600	2,400	1,800	1,440	1,200	1,029	900	800	720	655	600	800
900	8,100	4,050	2,700	2,025	1,620	1,350	1,157	1,013	900	810	736	675	900
1,000	9,000	4,500	3,000	2,250	1,800	1,500	1,286	1,125	1,000	900	818	750	1,000
1,100	9,900	4,950	3,300	2,475	1,980	1,650	1,415	1,237	1,100	990	910	825	1,100
1,200	10,800	5,400	3,600	2,700	2,160	1,800	1,543	1,350	1,200	1,080	982	900	1,200
1,300	11,700	5,850	3,900	2,925	2,340	1,950	1,671	1,462	1,300	1,170	1,064	975	1,300
1,400	12,600	6,300	4,200	3,150	2,520	2,100	1,800	1,575	1,400	1,260	1,146	1,050	1,400
1,500	13,500	6,750	4,500	3,375	2,700	2,250	1,929	1,688	1,500	1,350	1,228	1,125	1,500

Example: Use 1-gallon application for 1,000-gallon truck. Spread 10 feet wide.

As the table is based on a 1.0-gallon spread per square yard, a 1,000-gallon truck will spread 900 lineal feet 10 feet wide.

For a 1/2-gallon application, etc.,  $900 \times 2 = 1,800$  lineal feet.

**Section 11 Liquid Asphalt Surface Treatments for Aggregate Base Roads  
(Quantities per Square Yard)  
Prime Coat to Be Omitted if Surface Has Been Previously Treated**

Treatment	Materials	Type of liquid asphalt	Method of application
1. Penetration.....	Light oil.....	SC-70 or SC-250.....	Sweep, penetrate with 1/4 to 1/2 gallon SC-70 or SC-250, blot with roadside cover.
2. Penetration and seal.....	Oils and sand.....	SC-70 to SC-800.....	Sweep, prime base with 1/4 gallon SC-70 to SC-800, cover with sand.
3. Penetration and seal.....	Cutbacks and sand.....	MC.....	Sweep, prime base with 1/4 gallon SC-70; allow to dry; apply 1/7 to 1/4 gallon MC; cover with 10 to 15 lbs. sand.
4. Penetration and seal.....	Hot asphalt and screenings..	200-300 or 85-100 penetration asphalt	Sweep, prime base with 1/4 gallon SC-70, allow to dry; apply 1/6 gallon 200-300 or 85-100 penetration asphalt; cover with 15 lbs. medium or fine screenings, roll.
5. Penetration and seal.....	Hot asphalt and screenings..	200-300 or 85-100 penetration asphalt	Sweep, prime base with 1/4 gallon SC-70, allow to dry; apply 1/5 gallon 200-300 or 85-100 penetration asphalt; cover with 20-25 lbs. medium screenings, roll.
6. Penetration and seal.....	Emulsion and sand.....	P types.....	Sweep, prime base with 1/4 gallon SC-70, allow to dry; apply 1/8 to 1/6 gallon P type emulsified asphalt; cover with 5 to 10 lbs. sand.
7. Penetration and seal.....	Emulsion and screenings....	P types.....	Sweep, prime base with 1/4 gallon SC-70, allow to dry; apply 1/6 to 1/5 gallon P type emulsified asphalt; cover with 15 lbs. medium or fine screenings, roll.
8. Penetration and seal.....	Emulsion and screenings....	P types.....	Sweep, prime base with 1/4 gallon SC-70, allow to dry; apply 1/5 to 1/4 gallon P type emulsified asphalt; cover with 20 to 25 lbs. medium screenings, roll.
9. Armor Coat.....	Hot asphalt and screenings..	200-300.....	Sweep, prime base with 1/4 gallon SC-70, allow to dry; apply 1/8 gallon 200-300; apply 60 lbs. 1/2" X 3/8" screenings; roll, then 3/8 gallon 200-300; cover with 25 lbs. medium screenings, roll.
10. Armor Coat.....	Emulsion and screenings....	P types.....	Sweep, prime base with 1/4 gallon SC-70, allow to dry; apply 1/8 gallon P type emulsified asphalt; apply 60 lbs. 1/2" X 3/8" screenings; roll, apply 3/8 gallon P type emulsified asphalt; cover with 25 lbs. medium screenings; roll, then 1/4 to 3/8 gallon P type emulsified asphalt; cover with 15 lbs. fine screenings, roll.
11. Armor Coat (Light).....	Emulsion and screenings....	P types.....	Sweep, prime base with 1/4 gallon SC-70, allow to dry; apply 1/8 gallon P type emulsified asphalt; apply 25 lbs. coarse screenings; roll, then 3/8 gallon P type emulsified asphalt; cover with 15 lbs. medium screenings, roll.
12. Road Mix, present base.	1 1/2" thick.....	SC-800, MC.....	Scarify approximately 1 1/2" deep, apply 1 gallon SC-800, or MC liquid asphalt in one or two applications; mix thoroughly, spread, then finish to cross section during compaction.

NOTE--Road mix application will vary according to various gradients of materials for treatment. See Standard Specifications for Armor Coat, Seal Coats, and Road Mix surface treatment. Types of oil will vary as to conditions, as well as results desired.

## **Section 12    Contents of Cylindrical Tanks    (Horizontal)**

**Full Capacity in Gallons=[.7854 x Dia.<sup>2</sup> (inches) x Length (Inches)] /231**

Percent of depth		Percent of capacity		Percent of depth		Percent of capacity	
1 filled	2 unfilled	1a filled	2a unfilled	1 filled	2 unfilled	1a filled	2a unfilled
1	99	0.20	99.80	26	74	20.73	79.27
2	98	0.50	99.50	27	73	21.86	78.14
3	97	0.90	99.10	28	72	23.00	77.00
4	96	1.34	98.66	29	71	24.07	75.93
5	95	1.87	98.13	30	70	25.31	74.69
6	94	2.45	97.55	31	69	26.48	73.52
7	93	3.07	96.93	32	68	27.66	72.34
8	92	3.74	96.26	33	67	28.84	71.16
9	91	4.45	95.55	34	66	30.03	69.97
10	90	5.20	94.80	35	65	31.19	68.81
11	89	5.98	94.02	36	64	32.44	67.56
12	88	6.80	93.20	37	63	33.66	66.34
13	87	7.64	92.36	38	62	34.90	65.10
14	86	8.50	91.50	39	61	36.14	63.86
15	85	9.40	90.60	40	60	37.39	62.61
16	84	10.32	89.68	41	59	38.64	61.36
17	83	11.27	88.73	42	58	39.89	60.11
18	82	12.24	87.76	43	57	41.14	58.86
19	81	13.23	86.77	44	56	42.40	57.60
20	80	14.23	85.77	45	55	43.66	56.34
21	79	15.26	84.74	46	54	44.92	55.08
22	78	16.32	83.68	47	53	46.19	53.81
23	77	17.40	82.60	48	52	47.45	52.55
24	76	18.50	81.50	49	51	48.73	51.27
25	75	19.61	80.39	50	50	50.00	50.00

Columns No. 1 and No. 1a should be used together to ascertain percentage of capacity filled when less than 50%.

Columns No. 2 and No. 2a should be used together to ascertain percentage of capacity filled when greater than 50%.

Example: A 1,000-gallon tank 6' 8" diameter has 20" fluid left.

How many gallons in tank?

6' 8" = 80" depth tank.

20 \_\_\_\_\_

80 \_\_\_\_\_ = 25% filled.

From table: 19.61 X 1,000 gallons = 196.1 gallons in tank.

## **Section 13     Sizes of Sieves**

U.S. Standard Sieves	Tyler Standard Sieves	Size of opening in inches	U.S. Standard Sieves	Tyler Standard Sieves	Size of opening in inches
4".....	.....	4	No. 3	.....	0.250
3".....	.....	3	No. 4	4 Mesh	0.187
2 $\frac{1}{2}$ ".....	.....	2 $\frac{1}{2}$	No. 8	8 Mesh	0.0937
2".....	.....	2	No. 16	14 Mesh	0.0469
1 $\frac{1}{2}$ ".....	.....	1 $\frac{1}{2}$	No. 30	28 Mesh	0.0232
1 $\frac{1}{4}$ ".....	.....	1 $\frac{1}{4}$	No. 50	48 Mesh	0.0117
1".....	.....	1	No. 100	100 Mesh	0.0059
$\frac{3}{4}$ ".....	.....	$\frac{3}{4}$	No. 200	200 Mesh	0.0029
$\frac{1}{4}$ ".....	.....	$\frac{1}{4}$	No. 270	270 Mesh	0.0021
$\frac{3}{8}$ ".....	.....	$\frac{3}{8}$			

## **Section 14     Grading Requirements for Asphalt Concrete Aggregate or Grading Requirements for Road-mix Surfacing Aggregate**

	Percentage Passing Sieves			
	$\frac{3}{4}$ " Maximum	$\frac{1}{2}$ " Maximum	$\frac{3}{8}$ " Maximum	No. 4 Maximum
Sieve sizes				
1".....	100	.....	.....	.....
$\frac{3}{4}$ ".....	95-100	100	.....	.....
$\frac{1}{2}$ ".....	.....	95-100	100	.....
$\frac{3}{8}$ ".....	65- 80	80- 95	95-100	100
No. 4.....	45- 60	55- 75	65- 85	95-100
No. 8.....	30- 45	38- 55	50- 70	70- 80
No. 30.....	15- 25	18- 33	28- 40	35- 70
No. 200.....	3- 7	4- 8	7- 14	7- 60
Approximate amount of liquid asphalt*				
+Lower limit...	3.9	3.9	4.2	4.5
+Upper limit...	4.6	4.7	5.0	5.3

\* The amount of liquid asphalt will vary from quantity shown for porous rock or different fines. The amounts shown are satisfactory for commercial plants. For ordinary conditions, SC-250, SC-800, MC-250, and MC-800 grades of liquid asphalt should be used.

+ The amount of asphalt required in the mix for either plant-mix surfacing or road-mix surfacing is to be determined from tests obtained from district laboratory.

The above gradings are satisfactory for patching material.

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## **Section 15     Grading Requirements for Sand for Slurry Seal**

Sieve Size	Percent Passing
4.....	100
8.....	95-100
16.....	60- 90
30.....	40- 65
200.....	8- 15

## **Section 16     Grading Requirements for Seal Coat Screenings**

Sieve Sizes	Percentage Passing Sieves			
	Coarse $\frac{1}{2}$ " x No. 4	Medium $\frac{3}{8}$ " x No. 6	Med. Fine $\frac{5}{16}$ " x No. 8	Fine $\frac{1}{4}$ " x No. 10
$\frac{3}{4}$ ".....	100	.....	.....	.....
$\frac{1}{2}$ ".....	90-100	100	.....	.....
$\frac{3}{8}$ ".....	50- 80	90-100	100	100
No. 3.....	10- 45	45- 70	70- 90	90-100
No. 4.....	0- 15	5- 30	30- 60	60- 85
No. 8.....	0- 5	0- 10	0- 15	0- 25
No. 16.....	.....	0- 5	0- 5	0- 5
No. 30.....	.....	.....	0- 3	0- 3
No. 200.....	0- 2	0- 2	0- 2	0- 2

## Section 17 Grading Requirements for Class 2 Aggregate

Sieve Sizes	Percentage Passing Sieves	
	1 1/2 " Maximum	3/4 " Maximum
2".....	100	.....
1 1/2 ".....	90-100	.....
1".....	.....	100
3/4 ".....	50- 85	90-100
No. 4.....	25- 45	35- 55
No. 30.....	10- 25	10- 30
No. 200.....	2- 9	2- 9

## Section 18 Sand or Screenings per Mile

**For Estimating Applications on Seal Coats**  
**Quantity of Screenings in Tons per Mile for Various Rates of Application**  
**(Tons Per Mile)**

Pounds per square yard	Width in feet										
	9	10	12	14	15	16	18	20	22	24	30
10.....	27	30	35	41	44	47	53	59	65	71	89
15.....	40	44	53	61	66	70	79	88	97	106	132
18.....	48	53	63	74	79	85	95	106	116	127	159
20.....	53	59	70	82	88	94	106	118	129	141	177
22.....	58	65	77	90	97	103	116	129	142	155	194
24.....	63	71	84	98	105	112	126	141	155	168	212
25.....	66	74	88	103	110	117	132	147	161	176	221
30.....	79	88	106	123	132	141	158	176	194	211	264
35.....	93	103	123	144	154	164	185	205	226	246	308
40.....	106	118	141	164	176	188	212	236	258	282	354
45.....	118	132	159	184	198	211	237	264	291	317	396
50.....	132	147	176	206	220	234	264	294	323	352	441
60.....	158	176	211	246	264	282	316	352	388	422	528

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## **Section 19    Lineal Feet Truck Spread**

**Sand or Screenings  
Lineal Feet Spread for Various Sized Trucks and Rates of Applications  
(Lineal Feet Spread)**

Application in pounds per square yard		Cubic yard trucks				
		1.0	1.5	2.0	3.0	4.0
		Pounds per load				
		2,700	4,050	5,400	8,100	10,800
1	Spread 7.5 feet wide.....	3,240.0	4,860.0	6,480.0	9,720.0	12,960.0
7		462.9	694.3	925.7	1,388.6	1,851.4
10		324.0	486.0	648.0	972.0	1,296.0
12		270.0	405.0	540.0	810.0	1,080.0
15		216.0	324.0	432.0	648.0	864.0
25		129.6	194.4	259.2	388.8	518.4
1	Spread 8.0 feet wide.....	3,037.5	4,556.2	6,075.0	9,112.5	12,150.0
7		433.9	650.9	867.9	1,301.8	1,735.7
10		303.8	455.6	607.5	911.2	1,215.0
12		253.1	379.7	506.2	759.4	1,012.5
15		202.5	303.7	405.0	607.5	810.0
25		121.5	182.2	243.0	364.5	486.0
1	Spread 9.0 feet wide.....	2,700.0	4,050.0	5,400.0	8,100.0	10,800.0
7		385.7	578.6	771.4	1,157.1	1,542.9
10		270.0	405.0	540.0	810.0	1,080.0
12		225.0	337.5	450.0	675.0	900.0
15		180.0	270.0	360.0	540.0	720.0
25		108.0	162.0	216.0	324.0	432.0
1	Spread 10.0 feet wide.....	2,430.0	3,645.0	4,860.0	7,290.0	9,720.0
7		347.1	520.7	694.3	1,041.4	1,388.6
10		243.0	364.5	486.0	729.0	972.0
12		202.5	303.7	405.0	607.5	810.0
15		162.0	243.0	324.0	486.0	648.0
25		97.2	145.8	194.4	291.6	388.8

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## Section 20 Aggregate per Mile

### Aggregate for One Mile Surfacing For Estimating Shoulder, Base or Surface Material

Thickness, inches	18' wide				20' wide				22' wide			
	Loose		Compact		Loose		Compact		Loose		Compact	
	Tons	Cu. yds.	Tons	Cu. yds.	Tons	Cu. yds.	Tons	Cu. yds.	Tons	Cu. yds.	Tons	Cu. yds.
1.....	439	293	586	439	489	326	652	489	537	358	717	537
2.....	880	587	1,174	880	978	652	1,304	978	1,076	717	1,434	1,076
3.....	1,320	880	1,760	1,320	1,467	978	1,956	1,467	1,613	1,075	2,150	1,613
4.....	1,760	1,173	2,346	1,760	1,956	1,304	2,608	1,956	2,151	1,434	2,868	2,151
5.....	2,199	1,466	2,932	2,199	2,445	1,630	3,260	2,445	2,688	1,792	3,584	2,688
6.....	2,640	1,760	3,520	2,640	2,934	1,956	3,912	2,934	3,225	2,150	4,300	3,225
7.....	3,080	2,053	4,106	3,080	3,423	2,282	4,564	3,423	3,764	2,509	5,018	3,764
8.....	3,520	2,347	4,694	3,520	3,912	2,608	5,216	3,912	4,300	2,867	5,732	4,300
9.....	3,960	2,640	5,280	3,960	4,400	2,933	5,866	4,400	4,838	3,225	6,450	4,838
10.....	4,400	2,933	5,866	4,400	4,888	3,259	6,518	4,888	5,376	3,584	7,168	5,376

Quantities based on--

1.5 tons = 1 cu. yd.

Loose cu. yds. = Actual yardage per mile.

Loose tons = 1.5 X actual yardage.

Compact tons = 2.0 X actual yardage.

Compact cu. yds. = 1.5 X actual yardage.

## Section 21 Spacing of One-ton Piles of Covering Material for Various Widths and Rates of Application

Application pounds per square yard	Spacing of 1-ton piles, in feet							
	Width for cover							
	7.5'	8.0'	9.0'	10.0'	15.0'	16.0'	18.0'	20.0'
5.....	480	452	400	360	240	226	200	180
7.....	342	322	286	257	171	161	143	129
10.....	240	226	200	180	120	113	100	90
12.....	200	188	166	150	100	94	83	75
15.....	160	151	133	120	80	75	66	60
20.....	120	113	100	90	60	56	50	45
25.....	96	90	80	72	48	45	40	36
30.....	80	75	66	60	40	38	33	30

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**Section 22     Cost of Aggregate per Square Yard at Various Rates of Spread  
and Unit Prices**

Pounds square yard	Prices per ton of aggregate, spread in place									
	\$1.00	\$1.50	\$2.00	\$2.50	\$3.00	\$3.50	\$4.00	\$4.50	\$5.00	\$6.00
5.....	.002	.004	.005	.006	.007	.009	.010	.011	.013	.015
10.....	.005	.007	.010	.012	.015	.017	.020	.022	.025	.030
15.....	.007	.011	.015	.019	.022	.026	.030	.034	.038	.045
20.....	.010	.015	.020	.025	.030	.035	.040	.045	.050	.060
25.....	.012	.019	.025	.031	.037	.044	.050	.056	.063	.075
30.....	.015	.022	.030	.037	.045	.052	.060	.067	.075	.090
35.....	.017	.026	.035	.044	.052	.061	.070	.079	.088	.105
40.....	.020	.030	.040	.050	.060	.070	.080	.090	.100	.120
45.....	.022	.034	.045	.056	.067	.079	.090	.101	.113	.135
50.....	.025	.037	.050	.062	.075	.087	.100	.112	.125	.150
60.....	.030	.045	.060	.075	.090	.105	.120	.135	.150	.180
75.....	.037	.056	.075	.094	.112	.131	.150	.169	.188	.225
100.....	.050	.075	.100	.125	.150	.175	.200	.225	.250	.300
150.....	.075	.112	.150	.187	.225	.262	.300	.337	.375	.450
200.....	.100	.150	.200	.250	.300	.350	.400	.450	.500	.600
250.....	.125	.187	.250	.312	.375	.437	.500	.562	.625	.750
300.....	.150	.225	.300	.375	.450	.525	.600	.675	.750	.900
400.....	.200	.300	.400	.500	.600	.700	.800	.900	1.000	1.200
500.....	.250	.375	.500	.625	.750	.875	1.000	1.125	1.250	1.500
600.....	.300	.450	.600	.750	.900	1.050	1.200	1.350	1.500	1.800

**Section 23     Square Yards of Surface per Mile for Various Widths of  
Roadway**

Width, feet	Surface, square yards	Width, feet	Surface, square yards
1.....	586.67	.....	.....
10.....	5,867	18.....	10,560
12.....	7,040	20.....	11,733
14.....	8,213	22.....	12,907
15.....	8,800	24.....	14,080
16.....	9,387	30.....	17,600

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## Section 24    **Weights and Volumes of Construction Materials**

### **Portland Cement**

1 bag (net) = 1 cu. ft. ....	94 pounds
1 barrel = 4 bags .....	376 pounds
A minimum car (in bags) .....	173 barrels
A medium car (in bags) .....	231 barrels
A large car (in bags) .....	289 barrels
Minimum shipment bulk cement by truck and trailer...	100 barrels

Example:    Concrete wall will require 12 cu. yds. Cl. "B" concrete to be mixed in a 1 1/2-sack mixer.

How many sacks cement will be required and how many batches necessary?

Cl. "B" concrete has 5 sacks cement per cu. yd.

12 cu. yd. X 5 = 60 sacks cement.

60

---- = 40 batches concrete required.

1.5

### **Lumber**

	Pounds per thousand feet, B.M.	
	Green	Dry
Timbers, rough.....	3,250	2,500
Lumber, rough.....	3,000	2,400
Lumber, dressed.....	2,500	2,000
Oak.....	5,500	4,000
Yellow pine.....	4,300	3,200
Redwood, rough.....	.....	2,500
Cedar.....	.....	2,300

Example: To figure FBM (Foot board measure)

1 FBM = 1" X 12" X 12" or 1 sq. ft. 1" thick.

How many FBM in 60 pieces 2" X 4" X 16"?

60 X 2 X 4 X 16 = 640 FBM.

12

**Broken Stone**

<u>1" to dust</u>	<u>Loose measure</u>
Crushed gravel	2,700 pounds per cu. yd.
Crushed limestone	2,550 pounds per cu. yd.
Crushed granite.	2,600 pounds per cu. yd.
Screenings.	2,400 pounds per cu. yd.
Limestone dust (approx.).	75-85 pounds per cu. ft.

**Sand**

Cubic foot	90-95 pounds
Cubic yard	2,400-2,600 pounds

**Soil**

Clay bearing. Dry loose	2,160 pounds per cu. yd.
Clay bearing. Dry compact.	3,600 pounds per cu. yd.

**Water**

Water (fresh)=	62.40 pounds per cu. ft. (approx.)
Water (salt)=	64.00 pounds per cu. ft. (approx.)
	=1.026 cu. ft. of pure water
C.F.S. =	Cubic feet per second, or second-feet.
G.P.M.	=Gallons per minute.
1-C.F.S.	=60 cu. ft. per min.
	= 86,400 cu. ft. per 24 hrs.
	= 1.9835 acre feet per 24 hrs. (usually taken as 2).
	= 40 Miners inches, Ariz., Calif., Mont. and Oregon.

**Ice and Snow**

- 1-C.F. of ice at 32°F. weighs 57.50 pounds.
- 1-C.F. of fresh snow, according to humidity of atmosphere, weighs 5 pounds to 12 pounds.
- 1-C.F. of snow moistened and compacted by rain weighs 15 pounds to 50 pounds.

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## **Section 25    Paint Coverage per Gallon**

<u>Type</u>	<u>Sq. ft. per gallon</u>
Wood preservative	100 one coat
Outside lead and oil	Approximately 300 two coats
Flat white paint	Approximately 300 two coats
Floor oil stain.	Approximately 600 one coat
Enamel, floor	250 two coats
Wallhide for wall board	300 one coat
Aluminum	500 one coat
Varnish	600 one coat
Exterior paint--wood	450 one coat
Exterior paint--metal.	350 one coat
Interior paint.	450 one coat

## **Section 26    Lineal Feet to Decimal of a Mile**

Lineal feet	Mile	Lineal feet	Mile	Lineal feet	Mile
5.....	0.001	60.....	0.011	600.....	0.114
10.....	0.002	70.....	0.013	700.....	0.133
15.....	0.003	80.....	0.015	800.....	0.152
20.....	0.004	90.....	0.017	900.....	0.170
25.....	0.005	100.....	0.019	1,000.....	0.189
30.....	0.006	200.....	0.038	2,000.....	0.379
35.....	0.007	300.....	0.057	3,000.....	0.568
40.....	0.008	400.....	0.076	4,000.....	0.758
50.....	0.009	500.....	0.095	5,000.....	0.947
				5,280.....	1.000

## Section 27 Inches to Decimal of a Foot

Inches	Foot	Inches	Foot	Inches	Foot
1/4.....	.021	2 3/4.....	.229	5 1/4.....	.438
1/2.....	.042	3.....	.250	5 1/2.....	.458
3/4.....	.062	3 1/4.....	.271	5 3/4.....	.478
1.....	.083	3 1/2.....	.292	6.....	.500
1 1/4.....	.104	3 3/4.....	.313	.....	.....
1 1/2.....	.125	4.....	.333	.....	.....
1 3/4.....	.146	4 1/4.....	.354	.....	.....
2.....	.166	4 1/2.....	.375	.....	.....
2 1/4.....	.187	4 3/4.....	.396	.....	.....
2 1/2.....	.208	5.....	.417	.....	.....

## Section 28 Plane Figures, Areas

<p><u>SQUARE</u></p> <p>Diagonal = <math>d = s \sqrt{2}</math>  Area = <math>s^2 = 4b^2 = 0.5d^2</math>.  Example. <math>s = 6, b = 3</math>. Area = <math>(6)^2 = 36</math> Ans.  <math>d = 6 \times 1.414 = 8.484</math> Ans.</p> <p><u>RECTANGLE AND PARALLELOGRAM</u></p> <p>Area = <math>ab</math> or <math>b \sqrt{a^2 - b^2}</math>  Example. <math>a = 6, b = 3</math>.  Area = <math>3 \times 6 = 18</math> Ans.</p>	<p><u>CIRCLE</u></p> <p><math>r</math> = radius  <math>d</math> = diameter  <math>c</math> = circumference  <math>A</math> = area  <math>\pi = 3.14159</math>  <math>A = \pi r^2 = 0.7854 \times d^2</math>  <math>c = 2 \pi r = \pi d</math>  Volume of a cylindrical tank  = Area of base X height</p>
---	--

## **Section 29 Miscellaneous, Conversion of Measures**

The metric system is a system of measures and weights, with the meter and gram as bases.

<u>The Greek prefix</u>	<u>Before a unit means</u>	<u>The Latin prefix</u>	<u>Before a unit means</u>
Deca	ten	deci	one tenth
Hecto	one hundred	centi	one hundredth
Kilo	one thousand	milli	one thousandth
Myria	ten thousand	micro	one millionth
Mega	one million		

### **CONVERSION OF MEASURES**

#### **Liquid Measure**

2 pints.....	= 1 quart.....	= 0.9463 liter
4 quarts.....	= 1 gallon.....	= 3.7853 liters
31 1/2 U.S. gallons.....	= 1 bbl. (ordinary).....	= 1.1924 hectoliters
42 U.S. gallons.....	= 1 bbl. (petroleum).....	= 1.5895 hectoliters
1 U.S. gallon.....	= 231 cubic inches.....	= 0.1337 cubic foot
1.201 U.S. gallons.....	= 277.3 cubic inches.....	= 1 Imperial gallon
7.48 U.S. gallons.....	= 1 cubic foot	

#### **Avoirdupois Weight**

1 grain.....	= 0.0648 gram	
27 11/32 grains.....	= 1 dram.....	= 1.7718 grams
16 drams.....	= 1 ounce.....	= 28.3495 grams
16 ounces.....	= 1 pound.....	= 0.4537 kilogram
2.204 pounds.....		= 1.0 kilogram
2,000 pounds.....	= 1 short ton.....	= 907.1849 kilograms
2,204 pounds.....	= 1 metric ton.....	= 1,000 kilograms
2,240 pounds.....	= 1 long ton.....	= 1,016.33 kilograms

#### **Troy Weight**

1 grain.....		= 0.0648 gram
24 grains.....	= 1 pennyweight.....	= 1.5552 grams
20 pennyweight.....	= 1 dram.....	= 21.1035 grams
12 ounces.....	= 1 pound.....	= 0.3732 kilogram

**Linear Measure**

1 inch.....	= 1/12 foot.....	= 2.54 centimeters
12 inches.....	= 1 foot.....	= 0.3048 meter
36 inches (3 feet).....	= 1 yard.....	= 0.9144 meter
39.37 inches (3.28 feet).....	= 1.0935 yards.....	= 1 meter
5 1/2 yards.....	= 1 rod.....	= 5.0298 meters
40 rods.....	= 1 furlong.....	= 201.1684 meters
8 furlongs (5,280 feet).....	= 1 mile.....	= 1.6093 kilometers
3 miles (15,840 feet).....	= 1 league.....	= 4.8280 kilometers
6, 080.27 feet.....	= 1 nautical mile	

**Square Measure**

1 square inch.....	= 6.4516 sq. centimeters
144 square inches.....	= 1 square foot..... = 0.0929 square meter
9 square feet.....	= 1 square yard..... = 0.8361 square meter
30 1/4 square yards.....	= 1 square rod..... = 25.29 square meters
160 square rods.....	= 1 acre (43,560 square feet) = 0.4047 hectare
640 acres.....	= 1 square mile..... = 258.9998 hectares

**Cubic Measure**

1 cubic inch.....	= 16.3872 cubic centimeters
231 cubic inches.....	= 1 gallon..... = 4.5459 liters
1,728 cubic inches.....	= 1 cubic foot..... = 0.0283 cubic meter
27 cubic feet.....	= 1 cubic yard..... = 0.7645 cubic meter
1 acre-foot.....	= .....12 acre-inches..... = .....43,560 cubic feet..... = 325,829 gallons

Doubling the diameter of a pipe increases its flow approximately six times

Water boils at 212°F. (100°C.) at sea level  
Sea water freezes at 27°F.  
pounds

Water freezes at 32°F. (0°C.)  
1 cubic foot of ice at 32°F. =57.5

## **Section 30 Strength Requirements for Metal Culverts**

- (A) Corrugated Metal Pipes--The required thickness of steel corrugated pipes with 2 2/3" X 1/2" corrugation under a given overfill is determined from Table 33-1. The given gage thickness shall be regarded as minimum values.
- (B) Structural Plate Pipes--The required thickness for structural steel plate circular pipes under a given overfill is determined from Table 7-851.5 F. The given gage thickness shall be regarded as minimum values.

**TABLE A**

**Maximum Height of Cover for Corrugated  
Steel Pipe With 2 2/3" x 1/2" Corrugations  
(Annular or Helical)**

Diameter (inches)	Maximum Height of Cover (Feet)				
	5/16" Rivets		3/8" Rivets		
	METAL THICKNESS IN INCHES				
	0.064	0.079	0.109	0.138	0.168
12 15 18 21 24 30 36  42 48 54 60 66 72 78 84	Single Riveted				
	63	83			
	50	66			
	42	55	84		
	36	47	72		
	32	42	61	75	
	25	33	49	60	
	21	28	41	50	
	Double Riveted				
	40	43	72	76	80
	35	38	63	67	70
	--	34	56	59	63
	--		50	53	56
	--		46	49	51
	--			45	47
	--			43	44
	--			40	40

NOTES:

- (1) Annular and longitudinal seams may be riveted or welded. Helical seams may be continuous lock seam or continuous welded. Pipes with lock seams limited to 48 inch maximum diameter.
- (2) When flow velocity with a full culvert at entrance exceeds 5 fps under abrasive conditions, thicker metal shall be provided.

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**Table B  
Maximum Height of Cover for Structural Steel Plate Circular Pipe with 6" X 2"  
Corrugations**

Diameter inches	Maximum Height of Cover (feet)							
	4-bolt seams							6-bolt seam
	METAL THICKNESS IN INCHES							
	0.109	0.138	0.168	0.188	0.218	0.249	0.280	0.280
60	42	62	80	93				
68	39	57	73	85				
72	35	52	67	78	94			
78	33	48	62	72	87			
84	30	45	57	67	80	95		
90	28	42	54	62	75	88	96	
96	27	39	50	58	70	83	90	
102	25	37	47	55	66	78	85	
108	24	35	45	51	63	74	80	
114	22	33	42	49	59	70	76	98
120	21	31	40	47	56	66	72	92
126	20	30	38	45	54	63	69	83
132	19	28	37	43	51	60	66	84
138	18	27	35	41	49	58	63	80
144	18	26	34	39	47	55	60	77
150	17	25	32	38	45	53	58	74
156	16	24	31	36	44	51	56	71
162	16	23	30	35	42	49	54	68
168	15	22	29	34	40	47	52	66
174	15	22	28	32	39	46	50	64
180	14	21	27	31	38	44	48	62
186	14	20	26	30	36	43	47	60
192		20	25	29	35	42	45	58
198		19	25	29	34	40	44	56
204		19	24	28	33	39	43	54
210		18	23	27	32	38	42	53
216		18	23	26	31	37	40	51
222			22	26	31	36	39	50
228			21	25	30	35	38	49
234			21	24	29	34	37	47
240				24	28	33	36	46
246				23	28	33	35	45
252				22	27	32	34	44

NOTES;

- 1) When flow velocities with full culvert at entrance exceeds 5 fps, thicker metal invert plates shall be provided for values left of heavy broken line.
- 2) For fill heights over 100', special design required.

### **Section 31 Strength Requirements for Reinforced Concrete Pipe**

- (A) D-Load Criterion. For purposes of this manual, the cracking D-load shall be the measure of strength of reinforced concrete pipe. It is the actual test load (in pounds per linear foot of pipe per foot of inside pipe diameter) under the 3-edge bearing method which produces a 0.01-inch crack throughout a length of 1 foot. Any reference to D-load will henceforth mean the cracking D-load.
- (B) Specifications and Special Requirements. Specifications for reinforced concrete pipe are based on ASTM Designation: M-170. Pipe shall be ordered or specified by strength class as shown in Table A. Neither D-load nor wall thickness shall be specified except when unusual conditions clearly call for special pipe. Unusual conditions which would dictate additional cover over the reinforcing steel include: (a) wear from abrasion or high velocities, and (b) corrosive environments. In these cases, 2 inches of cover shall be specified; to call for a thick wall does not ensure the required cover.

For uses of the various classes of pipe, see Table A.

- (C) Height of Overfill. Table B gives the safe overfills for commercial sizes of concrete pipe relative to Method "A" and Method "B" backfill. This table has been computed on the premise that a certain amount of yielding will occur in the foundation as anticipated in the installation methods prescribed in the Standard Specifications. Before selecting the appropriate pipe class from the table, the method of backfill and foundation conditions must be appraised from available data.

### **Section 32.01 Backfill Considerations Regarding Metal and Concrete Pipes**

The height of overfill a culvert will safely sustain depends upon the structural strength and rigidity of the culvert barrel, foundation conditions and methods of installation. Only the methods of backfill prescribed in the Standard Specifications are discussed here. For further information the way earth loads affect culverts, current literature including California Culvert Practice should be consulted.

- (A) Method "A" Backfill. This method requires that all the backfill material be compacted and applies to both rigid and flexible culverts. An installation using Method "A" is usually more economical than one by Method "B".
- (B) Method "B" Backfill. Method "B" backfill shall apply only to rigid pipes and box culverts. Method "B" calls for placing the pipe or box in a trench with vertical sides. This involves placing compacted backfill (Method "A") below a horizontal plane 1/2 foot above the top of the culvert and loose backfill above that to a depth equal to the exterior vertical dimension (structure depth) of the culvert barrel.

**TABLE A. Strengths and Uses of Reinforced Concrete Pipe**

*Class	Diameters (Inches)	Cracking D-Load	Principal highway uses
I	60-108	800D	Not adequate for highway uses
II	12-108	1000D	Use outside the roadbed under moderately low depths of cover (See Table B). This class is required for pipe shaft manholes and drop inlets.
III	12-108	1350D	Intended for normal culvert and storm drain uses.
IV	12-84	2000D	Same as Class III but will sustain higher overfills.
V	12-72	3000D	High strength pipe for severe loading conditions.

\* ASTM Designation: M-170

**TABLE B. Safe Overfills for Reinforced Concrete Pipe**

Inside Diameter (Inclusive) Inches	Safe Heights of Overfill in Feet			
	Class II 1000D	Class III 1350D	Class IV 2000D	Class V 3000D
Method "A" Backfill				
12-18	18	23	32	47
21-27	19	24	33	47
30-39	19	25	34	49
42-48	19	25	35	50
51-63	20	25	35	51
66-72	20	25	36	52
75-84	20	25	36	Not listed
87-108	20	26	Not listed	Not listed
Method "B" Backfill				
48 or less	↑	No limit	↑	↑
51	↑	70	↑	No limit
54-72	↑	↑	No limit	↓
75-81	See Note 2	↑	↓	↑
84	↓	See Note 2	117	Not listed
87-108	↓	↓	Not listed	↓

- NOTES: 1. All pipe conforms to current ASTM designation: M-170  
 2. Use method "A" and stronger pipe up to the limit of overfill shown under Method "A".

Method "B" backfill offers no benefits for flexible pipes because distortion by strutting accomplishes the same results as the loose backfill above the structure. The loose material induces arch action in the overlying fill somewhat in the manner of a tunnel and results in less pressure on the culvert than backfill by Method "A." Method "B" thus permits higher safe overfills for the same strength of culvert than would be allowable under Method "A."

Method "B" backfill shall not be used for concrete pipes or box culverts where the depth of cover over the culvert is less than three times the structure depth.

In the culvert placed under a fill by Method "B," the loose backfill should terminate at a point on the side slope where the limiting height of loose cover is reached (one structure depth plus 1/2 foot above the top of the culvert). Method "A" is used below this level to the end of the fill slope.

Method "B" shall be used only when it yields savings over other alternatives.

### **Section 32 Culvert Shipment Data**

Culverts take a fifth-class rating with a minimum of 20,000 pounds in either carload lots or truckload lots, and second-class rating in less than carload or truckload lots. In submitting requisitions for shipment for culverts, the necessary band couplers should be included.

**Section 33 Gages Corrugated Metal Pipe**

Nominal diameter (inches)	End area (sq. ft.)	Gage of culvert sheets	Minimum gage of connecting bands	Plain galvanized weight per lin. ft. (pounds)
8.....	.349	16	16	7
8.....	.349	14	16	9
10.....	.545	16	16	9
10.....	.545	14	16	11
12.....	.785	16	16	10
12.....	.785	14	16	13
15.....	1.227	16	16	13
15.....	1.227	14	16	16
15.....	1.227	12	14	22
18.....	1.767	16	16	15
18.....	1.767	14	16	19
18.....	1.767	12	14	26
21.....	2.405	16	16	18
21.....	2.405	14	16	22
21.....	2.405	12	14	31
21.....	2.405	10	12	39
24.....	3.142	14	16	25
24.....	3.142	12	14	35
24.....	3.142	10	12	44
30.....	4.909	14	16	31
30.....	4.909	12	14	43
30.....	4.909	10	12	55
30.....	4.909	8	12	66
36.....	7.069	12	14	51
36.....	7.069	10	12	65
36.....	7.069	8	12	79
42.....	9.621	12	14	60
42.....	9.621	10	12	77
42.....	9.621	8	12	93
48.....	12.566	12	14	68
48.....	12.566	10	12	87
48.....	12.566	8	12	106
54.....	15.904	12	14	78
54.....	15.904	10	12	100
54.....	15.904	8	12	121
60.....	19.635	10	12	110
60.....	19.635	8	12	134
66.....	23.758	10	12	121
66.....	23.758	8	12	146
72.....	28.274	10	12	130
72.....	28.274	8	12	159
78.....	33.183	8	12	176
84.....	38.485	8	12	190
90.....	44.179	8	12	201
96.....	50.265	8	12	212

## Section 34 Sacked Portland Cement Concrete Riprap

For location where rock or riprap protection of fill slopes is not available at reasonable cost, sacked portland cement concrete riprap may be used to advantage. Experience indicates that various coverages and thicknesses can be controlled by the degree of bulking of the sacks, which in turn is controlled by the sack tie. The sacks shall be placed so that the face coverage per cubic yard of concrete riprap measured on the slope shall not be more than 27 square feet nor less than 26 square feet exclusive of foundations, cut-off stubs and end returns. Further details covering sacked portland cement concrete riprap will be found under Section 72 of the Standard Specifications.

## Section 35 Blocks and Tackle

Block and tackle arrangements are one of the common tools employed by construction personnel. With the proper combination of rope and blocks, many heavy jobs can be easily done.

Use blocks as large as the job requires, too small a block bends the rope too sharply and too large a rope causes excessive friction on the sheaves and blocks. The proper size rope for different blocks is:

<i>Size of block (inches)</i>	<i>Rope diameter (inches)</i>	<i>Size of block (inches)</i>	<i>Rope diameter (inches)</i>
3.....	3/8	9.....	1
4.....	1/2	10.....	1 1/8
5.....	9/16 - 5/8	12.....	1 1/4
6.....	3/4	14.....	1 3/8
7.....	3/16 - 7/8	15.....	1 1/2
8.....	7/8 - 1	16.....	1 5/8

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### **LINE PARTS AND HOOK PULL**

LINE PARTS- Number of lines strung through or supporting the moving block.  
HOOKPULL- Theoretically the pull at the hook is equal to "head line" pull multiplied by the number of line parts. Actually the friction of the sheave bearings and the work of bending the rope around the sheaves reduces the effective pull. The more parts the greater the loss from friction.

Example: Load to be lifted, 200 pounds. Tackle: One single and one double block.

$\frac{200 \text{ lbs.}}{3 \times 0.90 \times 0.90 \times 0.90} = 91.44 \text{ lbs. pull}$
(Number of sheaves)      (Efficiency of each sheave)

### **Minimum Breaking Strength of Rope**

<i>Rope diameter (inches)</i>	<i>Manila 100 percent pounds</i>	<i>Rope diameter (inches)</i>	<i>Manila 100 percent pounds</i>
3/8	1,350	1	9,000
1/2	2,650	1 1/2	26,500
3/4	5,400	2	31,000

## Section 36 Metric Conversion Charts

### Common Conversion Factors to Metric

<b>Class</b>	<b>Multiply:</b>	<b>By:</b>	<b>To Get:</b>
Area *	ft <sup>2</sup>	0.0929	m <sup>2</sup>
	yd <sup>2</sup>	0.8361	m <sup>2</sup>
	mi <sup>2</sup>	2.590	km <sup>2</sup>
Length *	ft	0.3048	m
	in	25.4	mm
	mi	1.6093	km
	yd	0.9144	m
Volume	ft <sup>3</sup>	0.0283	m <sup>3</sup>
	gal	3.785	L **
	fl oz	29.574	mL **
	yd <sup>3</sup>	0.7646	m <sup>3</sup>
	acre ft	1233.49	m <sup>3</sup>
Mass	oz	28.35	g
	lb	0.4536	kg
	kip (1,000 lb)	0.4536	tonne (1000 kg)
	short ton (2,000 lb)	907.2	kg
	short ton	0.9072	tonne (1000 kg)
Density	lb/yd <sup>3</sup>	0.5933	kg/m <sup>3</sup>
	lb/ft <sup>3</sup>	16.0185	kg/m <sup>3</sup>
Pressure	psi	6894.8	Pa
	ksi	6.8948	MPa (N/mm <sup>2</sup> )
	lb <sub>f</sub> /ft <sup>2</sup>	47.88	Pa
Velocity	ft/s	0.3048	m/s
	mph	0.4470	m/s
	mph	1.6093	km/h
Light	footcandle (or) lumen/ft <sup>2</sup>	10.764	lux (lx) (or) lumen/m <sup>2</sup>
Temperature	°F	$t_{°C} = (t_{°F} - 32) / 1.8$	°C

\* For land surveying, see "Land Surveying Conversion Factors" table.

\*\* Use Capital "L" for liter to eliminate confusion with the numeral "1".

### Less Common Conversion Factors

<b>Class</b>	<b>Multiply:</b>	<b>By:</b>	<b>To Get:</b>
Density: Gravity Force	1b <sub>f</sub> /ft <sup>3</sup>	157.0	N/m <sup>3</sup>
	1b <sub>f</sub> /in <sup>3</sup>	271.0	kN/m <sup>3</sup>
	kg <sub>f</sub> /m <sup>3</sup>	9.81	N/m <sup>3</sup>
Density: Mass	1b <sub>m</sub> /in <sup>3</sup>	27.68	Mg/m <sup>3</sup>
	1b <sub>m</sub> /gal (US)	119.8	kg/m <sup>3</sup>
Force (including gravity force)	dyne	0.01	mN
	kg <sub>f</sub>	9.81	N
	oz <sub>f</sub>	0.278	N
	1b <sub>f</sub>	4.45	N
	ton <sub>f</sub> (2000 1b <sub>f</sub> )	8.90	kN
Mass	carat (metric)	0.2	g
	oz <sub>m</sub> (avoirdupois)	28.35	g
	oz <sub>m</sub> (troy)	31.10	g
	1b <sub>m</sub>	0.454	kg
	slug	14.6	kg
	ton <sub>m</sub> (short)	0.907	Mg

Note: The Metric System eliminates the confusion in US terminology about "weight" by separating it into two definitions: "mass", and "gravity force". Mass refers to the inertia of an object, or the force required to accelerate or decelerate it in a gravity-free environment. Gravity force is the net downward force acting on a stationary object to attract it to another, always proportional to the strength of the gravitational field and the object's mass.

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**Land Surveying Conversion Factors**

<b>Class</b>	<b>Multiply:</b>	<b>By:</b>	<b>To Get</b>
Area	acre	4046.872 61	m <sup>2</sup>
	acre	0.404 69	ha (10 000 m <sup>2</sup> )
Length	ft	1200/3937*	m

\* Exact, By definition of the US Survey foot, Section 8810, State of California Public Resources Code

**Speed Conversion Table**

<b>Current (mph)</b>	<b>Metric (km/h)</b>
<b>25</b>	<b>40</b>
<b>35</b>	<b>60</b>
<b>45</b>	<b>70</b>
<b>55</b>	<b>90</b>
<b>65</b>	<b>110</b>
<b>75</b>	<b>120</b>